Appendix A

Detailed Project Description

This page is left blank intentionally.

Table of Contents

List of Tables

List of Figures

List of Acronyms

amsl	above mean sea level
Applicant, the	Haile Gold Mine, Inc.
CIL	carbon in leach
Central Electric	Central Electric Power Cooperative
CPS	Coastal Plains Sand
cy	cubic yard(s)
EAP	Emergency Action Plan
gpm	gallons per minute
HDPE	high-density polyethylene
kton	kiloton(s)
kV	kilovolt
Haile	Haile Gold Mine, Inc.
HCO_3	bicarbonate
LCRS	leak collection and recovery system
Lynches River	Lynches River Rural Electric Cooperative
mil	a mil is one one-thousandth of an inch
MW	megawatt(s)
NH_4	ammonium
North Fork	North Fork of Haile Gold Mine Creek
NPDES	National Pollutant Discharge Elimination System
OCN-	cyanate
opt	ounces per ton
OSA	overburden storage area
PAG	potentially acid-generating
PMP	probable maximum precipitation
ppm	parts per million
proposed Project	Haile Gold Mine Project
rec oz/t	recoverable troy ounce per ton
SCDHEC	South Carolina Department of Health and Environmental Control
SR	State Road
TSF	tailings storage facility
US 601	US Highway 601

UV	ultraviolet
WAD	weak acid dissociable

A. DESCRIPTION OF THE PROPOSED HAILE GOLD MINE PROJECT

This appendix, prepared in cooperation with Haile, describes the Proposed Haile Gold Mine Project (the proposed Project) in detail, including the ore mining and processing operations that would recover gold and silver[1] by excavating pits to mine the ore, storing excavated soils and overburden, processing the ore, managing surface water and groundwater during operations, reclaiming the site at the end of operations, and post-mining monitoring. The components of the proposed Project are summarized in Section A.3, “Overview of the Proposed Project,” and each component is discussed in detail in the sections of the appendix that follow.

A.1 Site Description

The proposed Haile Gold Mine is located 3 miles northeast of the Town of Kershaw in southern Lancaster County, South Carolina (Figure A-1). Lancaster County lies in the north-central part of the state. The Haile Gold Mine is approximately 17 miles southeast of the City of Lancaster, the county seat, which is approximately 30 miles south of Charlotte, North Carolina.

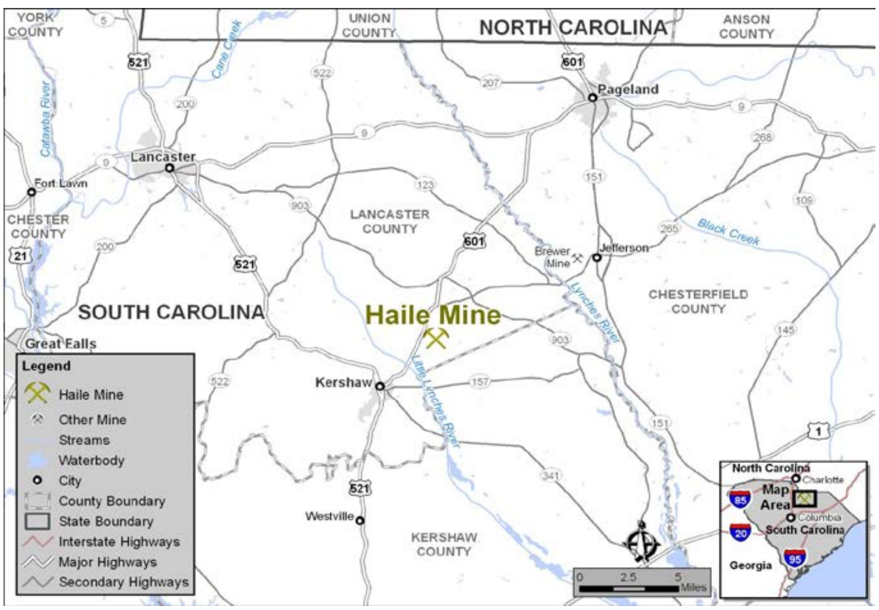


Figure A-1 Vicinity Map of the Proposed Project

Source: ESRI 2008.

Figure A-2 shows the Project area in greater detail, including the Project boundary within which all planned mine activity would occur. It also shows the location of specific elements of the mining activity (discussed in greater detail later in this appendix) and local roads. US Highway 601 (US 601) runs along

[1] Although approximately 50 percent more silver than gold would be extracted from the Haile Gold Mine by volume, Haile Gold Mine is considered a gold mine because the value of the gold exceeds the value of the silver at a general ratio of 50:1 (or more). Thus, the gold reserve is what makes Haile Gold Mine a valuable ore body to mine. For convenience, the environmental impact statement refers to ore extraction and processing in terms of gold production.

the west side of the main portion of the Project area; the proposed tailings storage facility (TSF) is located west of US 601 at the north end of the Project area. Haile Gold Mine Road enters the south end of the Project area, east of US 601. Snowy Owl Road, Gene Lewellen Road, and Bumblebee Road currently run through the Project area; and Haile Gold Mine, Inc. (Haile or the Applicant) is seeking authorization to close these roads prior to construction. Ernest Scott Road bounds the Project area on the east side.

A.2 Ore Reserve to Be Mined

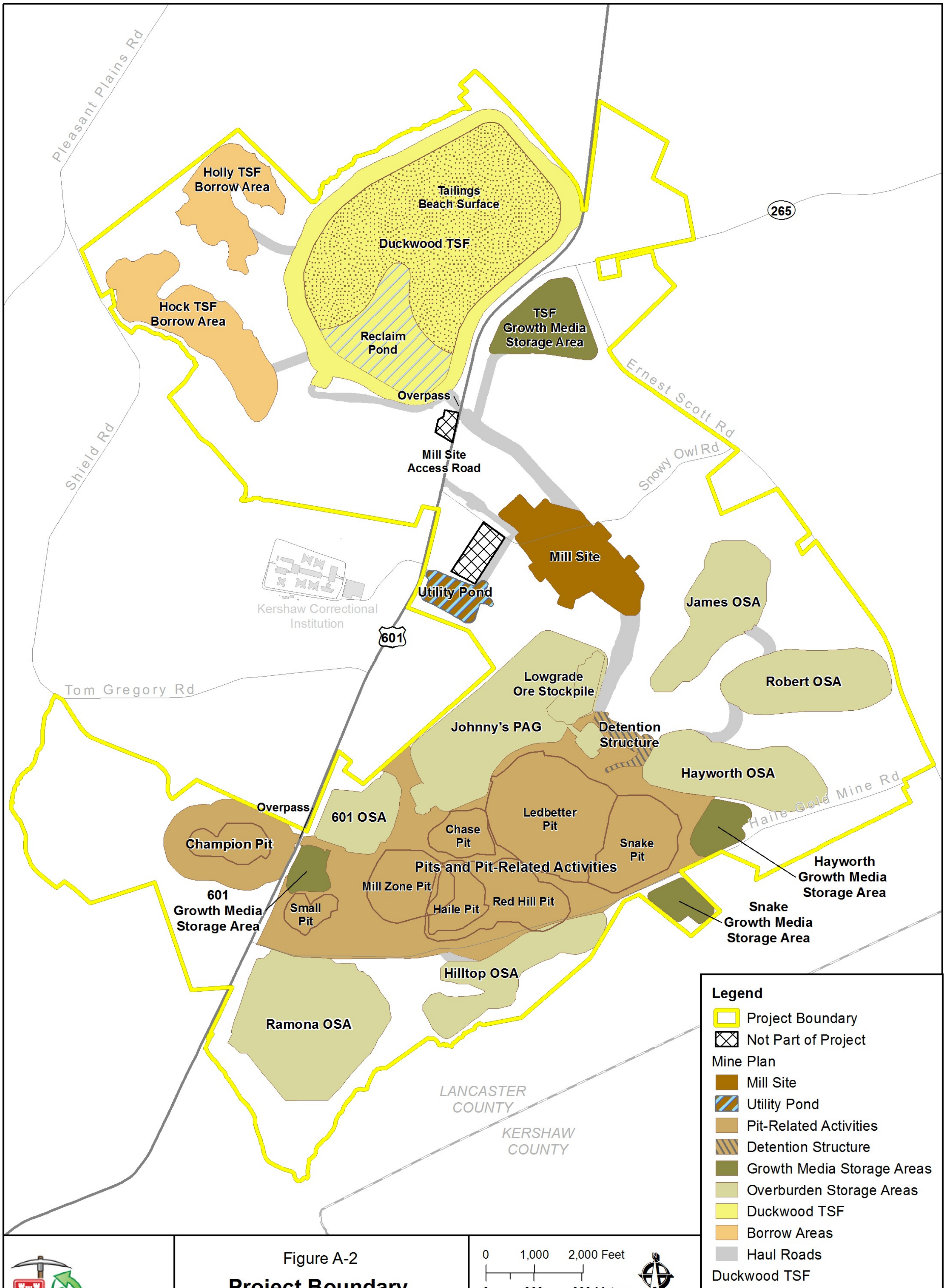
Haile's Feasibility Study has identified gold-bearing minerals that could be economically recovered within the Project area (M3 Engineering & Technology 2010). These gold-bearing minerals are known as reserves Use of the term *reserves* is limited to ore bodies that have been subjected to a thorough analysis of extensive exploratory drilling results and a comprehensive evaluation of technical and economic feasibility based on mining industry investment standards.[2] The plan for mining a defined reserve (the expected pit locations and the depths and pace of mining) is called the *mine plan* and is set out initially in a feasibility study. Areas that may contain gold-bearing minerals, but that have not been subjected to rigorous subsurface evaluation and feasibility analysis, may be considered *resources* and are differentiated from reserves. Resources are not considered for inclusion in a mine plan unless further studies convert the resources into reserves. The term *mineralization* refers to rock that contains, or is likely to contain, gold. Mineralization or mineralized strata can occur in both reserves and resources, as well as outside of them, as these terms simply indicate the potential for the rock strata to contain precious minerals.

Haile uses a mineralization cutoff grade to classify ore for processing. For example, during Mine Year 5 of the mine plan, "high grade ore" (above a 0.022 recoverable troy ounce per ton [rec oz/t] cutoff averaging 0.061 oz/t of gold) is processed as it is mined from the pits. "Low grade ore" (above 0.010 rec oz/t cutoff averaging 0.021 oz/t of gold) is stored for processing after active mining is completed (in the final 2 years of the mine plan).

The mine plan identifies the pits where the reserves would be mined. Haile plans to initiate mining the pits in the following order (see Section A.4, "Project Sequence" for more details):

- Mill Zone Pit
- Snake Pit
- Haile Pit
- Red Hill Pit
- Ledbetter Pit
- Chase Pit
- Champion Pit
- Small Pit

[2] Declaration of a reserve is governed by public disclosure requirements applicable in the United States and Canada. *See* U.S. Securities and Exchange Commission *Industry Guide 7* (August 13, 1992); Canadian Institute of Mining, Metallurgy, and Petroleum *Definition Standards for Mineral Resources and Reserves* (December 11, 2005).



Haile Gold Mine Environmental Impact Statement
www.HaileGoldMineEIS.com

Figure A-2

Project Boundary, Major Mine Features, and Roads

Sources: ESRI 2008, Haile 2013.

Figure A-3 depicts the reserves, with the pits identified and the expected zone of mining indicated as the reserve ore. The location noted as South Pit on this figure contains the Mill Zone, Haile, and Red Hill Pits.

As reported in public disclosures by Haile, the figure also shows resources known as Palomino, Mustang, and Horseshoe. These resources have been identified from exploration and are found largely at greater depths than the reserves. Haile does not have as much information for these resources as it has for its planned reserves and pits. Mining of these resources is not part of the mine plan or part of Haile's Section 404 permit application. Before mining of Palomino, Mustang, or Horseshoe could occur, additional studies and permitting would be needed.

The upper image in Figure A-3 is a plan view from the surface to depths in excess of 2,500 feet. The reserve is shown in red, and the mineralization outside of the reserve is shown in purple. Both have been estimated from drilling results. These colored areas are derived from individual 25- by 25- by 20-foot blocks that the model has joined to show areas of gold mineralization. The proposed pits are labeled in black, and resources identified from exploration that are not part of the mine plan are labeled in blue. The reserve and mineralization show all identified blocks above 0.012 ounces per ton (opt) and do not represent the varieties of quality, as all blocks are shown in the same color.

The lower image in Figure A-3 is a cross-section view of the same features looking to the north. A green line has been added to show the outline of the reserve pits. This image shows a total view and shows the reserve and mineralization compressed from a large slice or view onto a single plane spatially. Because of the compression, the fact that mineralized material can be separated by significant amounts of non-gold-bearing material is not illustrated in this figure. Consequently, the figure looks as if the gold-bearing zones are solid, which they are not. Both images depict an area approximately 11,000 feet or 3.35 kilometers in length.

A.3 Overview of the Proposed Project

This section provides an overview of the proposed Project. Development and operations of the gold mine would take place over an approximately 15-year period. "Pre-Production" (also called "Mine Year 0") would include construction of major facilities and preparation of the first pits for mining; this work would last slightly longer than 1 year. Twelve years would be spent actively mining, and a final 2 years would be spent processing low grade ore that has already been mined and reclaiming pits and overburden storage areas (OSAs) that were not concurrently reclaimed during active mining.

The proposed Project includes the following major components:

- Eight open pits and associated haul roads where gold reserves would be mined.
- Four growth media storage areas and seven OSAs for storage of surface soils and overburden removed from the pits to expose the gold reserves, and for associated haul roads.
- A Mill for processing the ore and refining the gold. The Mill Site also includes water treatment facilities, materials storage, administrative offices, a truck shop, a warehouse, and ancillary facilities.
- A TSF for permanent storage of tailings (a byproduct of the ore recovery process), a slurry pipeline to transport the tailings from the Mill to the TSF, and an access road.
- Two material borrow sites that would provide a portion of the construction material for building the TSF.

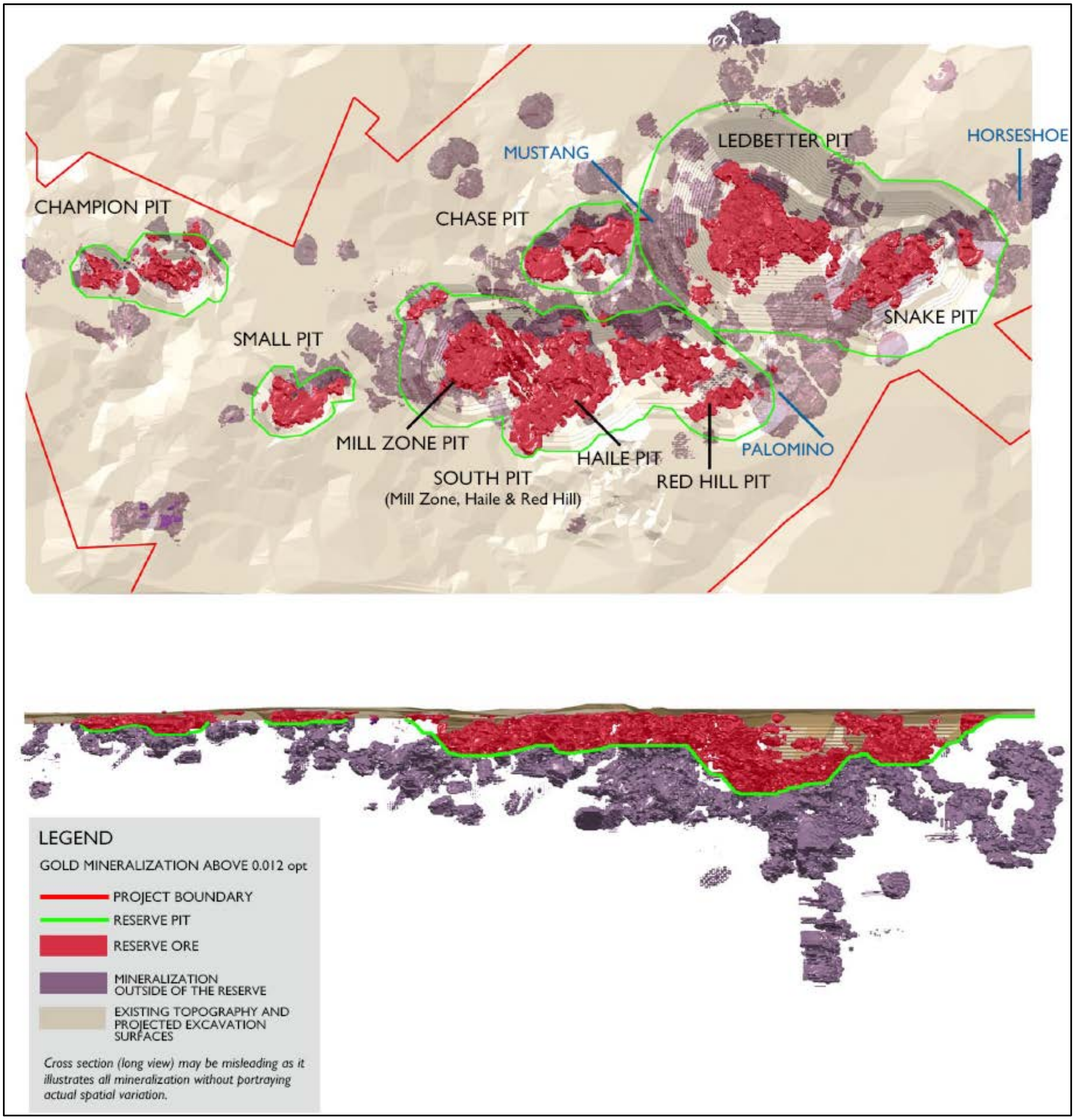


Figure A-3 Gold Reserve and Resources – Haile Gold Mine

Note: It should be noted that the images in Figure A-3 are representational only because they cannot fully depict the vertical or horizontal separation of the drilling results, leaving the impression that both the reserves and the resources extend almost solidly through the area. The upper image in Figure A-3 shows a plan view of the proposed pits, the reserve, and identified gold mineralization outside of the reserve pits. The lower image in Figure A-3 is a cross-section view looking to the north of the same features. A green line has been added in order to show the outline of the reserve pits. Together, these images provide a general representation of the spatial location, depth, and shape of the mineralization.

Source: Haile 2013a.

- Temporary diversion of the North Fork of Haile Gold Mine Creek (North Fork) and portions of Haile Gold Mine Creek into pipes during mining operations.
- An access road to the Project area and two overpasses over US 601 for access from the Mill to the TSF and for access from the Mill to Champion Pit.

The major elements are shown in Figure A-4, a plan view of the Project area representing all facilities over the life of the mine, and in Figure A-5, an aerial view of the simulated facilities in Mine Year 7 of operations.

The area disturbed by each of the Project elements is shown in Table A-1. Together, all of the Project elements would disturb 2,612 acres of the Project area.

A few notable aspects of the Project design and operations include:

- Approximately 120.5 acres of wetlands and 26,461 linear feet of stream course would be disturbed during construction and operations of the Project. Haile has proposed mitigation for these impacts, including avoidance, minimization, and compensation for unavoidable impacts. Proposed reclamation activities include restoration of on-site streams.
- Water used in the Project area would be managed to maximize recycling and reuse. Process water for operations of the Mill would consist of reclaimed water from Mill operations, reclaimed water from the TSF, groundwater pumping to lower the groundwater in the vicinity of the mining pits, and contact waters (as needed for makeup).
    - Process water within the Mill and TSF would be managed in a closed-loop system. Thus, discharge of process water to surface waterbodies or groundwater would not occur.
    - A contact water treatment plant would treat non-process contact water subject to National Pollutant Discharge Elimination System (NPDES) standards.
    - Only treated water or water that does not require treatment would be discharged.
- In addition to crushing methods, the Mill would use a sodium cyanide chemical extraction process in tanks to refine gold from the ore. Chemicals and reagents (chemicals and solutions used in the processing system) would be stored and used within containment structures to protect against their release to the environment. Cyanide would be present only in the closed-loop process water used at the Mill. Under normal operating conditions, flow from the Mill would be pumped to the TSF. If the cyanide level is greater than or equal to 50 parts per million (ppm) weak acid dissociable (WAD) cyanide, the flow would be directed to the cyanide destruction tanks, where cyanide levels would be lowered to below 50 ppm WAD using a sulfur dioxide and air process. In the TSF, ultraviolet (UV) sunlight and air would naturally decompose cyanide and cyanide complexes to further decrease cyanide levels.
- Reclamation would occur during and after active mining. Reclamation concurrent with mining would include re-filling and re-grading five pits. Three pits would become pit lakes. Concurrent and post-mining reclamation would include grading and revegetation of the OSAs and TSF. Ongoing maintenance and monitoring of site conditions would continue following completion of reclamation.

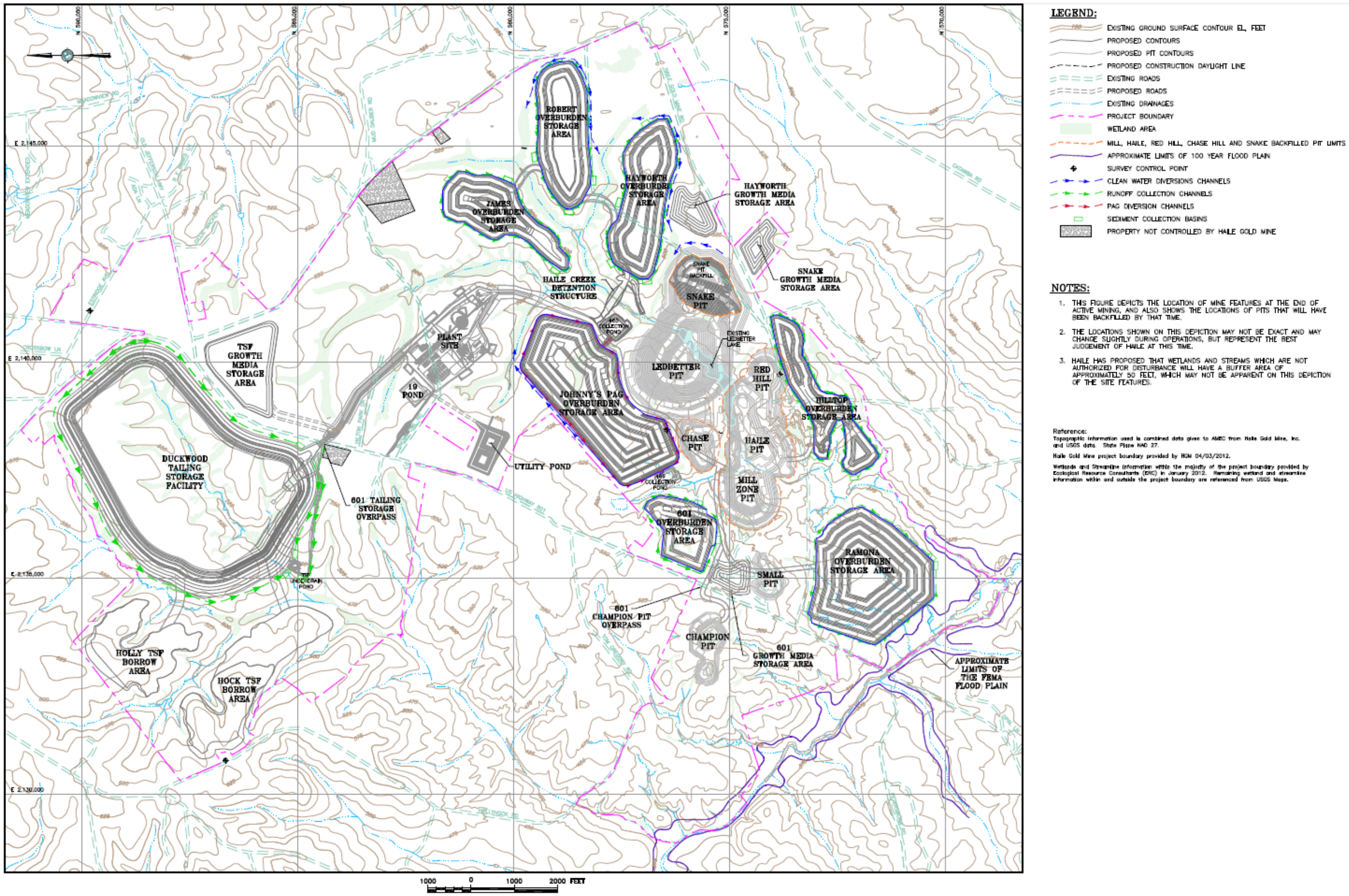


Figure A-4 Proposed Project – Plan View of the Project Area

Source: Haile 2013a.

Figure A-5 Simulated Aerial View of Haile Gold Mine Operations (Mine Year 7)

Source: NAIP 2011.

Table A-1 Project Footprint by Major Component

Mine Component[a]	Approximate Area (acres)
Mine pits, pit-related activities, and haul roads	766
Overburden storage areas, growth media storage areas, and haul roads	933
Mill, associated ore storage and support facilities, and haul roads	184
Tailings storage facility and associated haul road and slurry pipeline	524
Material borrow areas and haul roads	187
Haile Gold Mine Creek detention structure	13
Site access road and US Highway 601 overpasses	5
Total estimated footprint (of 4,552 acres in the Project area)	**2,612**

Notes:

Table A-1 does not account for 50-foot areas around mine components that are identified as areas of "additional disturbance" in the Section 404 permit application; Haile would try to avoid disturbance in this zone (areas where mine components abut wetlands, streams, or related buffers). See Section A.12, "Wetlands" for additional details.

[a] The footprint of each mine component includes not only related haul roads but also all other related support facilities (including stormwater management, temporary laydown areas, utilities, and pumping wells).

Source: Haile 2013a.

The following sections discuss the schedule for development and operations of the mine, and describe in detail the major elements and features of Project design and operations.

A.4 Project Sequence

The mine would be developed and operated over a 15-year lifespan, including pre-production and construction, 12 years of active mining, and 2 years of continued ore processing after mining is completed. Some locations would be reclaimed concurrently with ongoing mining (concurrent reclamation), and final site reclamation would occur after mining and processing of ore ceases.

Figure A-6 shows the eight separate pits to be mined and the order in which the pits would be developed.

The total planned footprint for the eight pits is approximately 766 acres (including the infrastructure necessary to support mining of the pits, such as haul roads, utility lines, pumping wells, temporary laydown areas, and stormwater management infrastructure). The excavated pit depths range from 110 to 840 feet below the original grade, which is a maximum depth of 380 feet below mean sea level. During concurrent reclamation (while other pits are being mined) Haile, Mill Zone, Red Hill, and Chase Pits would be completely backfilled and Snake Pit would be partially backfilled. *Backfilling* is the process of refilling the open pit with the material called *overburden* (material not sent for processing at the Mill) that is removed from pits being actively mined. (Refer to Section A.6, "Overburden Storage Areas" for details.)

Figure A-6 General Order of Pit Development

Source: Haile 2013a.

Ledbetter, Small, and Champion Pits would be allowed to re-fill with groundwater and surface water to form pit lakes that would be managed for acidity. The portion of Snake Pit that is not backfilled would form a lake that ultimately would become part of Ledbetter Pit Lake. All three pit lakes are expected to take approximately 20 to 25 years or more to fill.[3] Re-filling of the pit lakes would coincide with the expected period of monitoring for reclamation. (Refer to Section A.11, "Site Reclamation" for additional information.)

Production at Haile Gold Mine would consist of the phased mining of multiple open pits to supply the Mill with ore at a planned rate of 7,000 tons per day, 365 days per year. In general, two pits would be mined simultaneously. One pit would be in the overburden stripping phase where overburden is removed. The other pit would be mined for ore and overburden. This approach would maintain a constant supply of ore to the Mill.

A.4.1 Mining Schedule

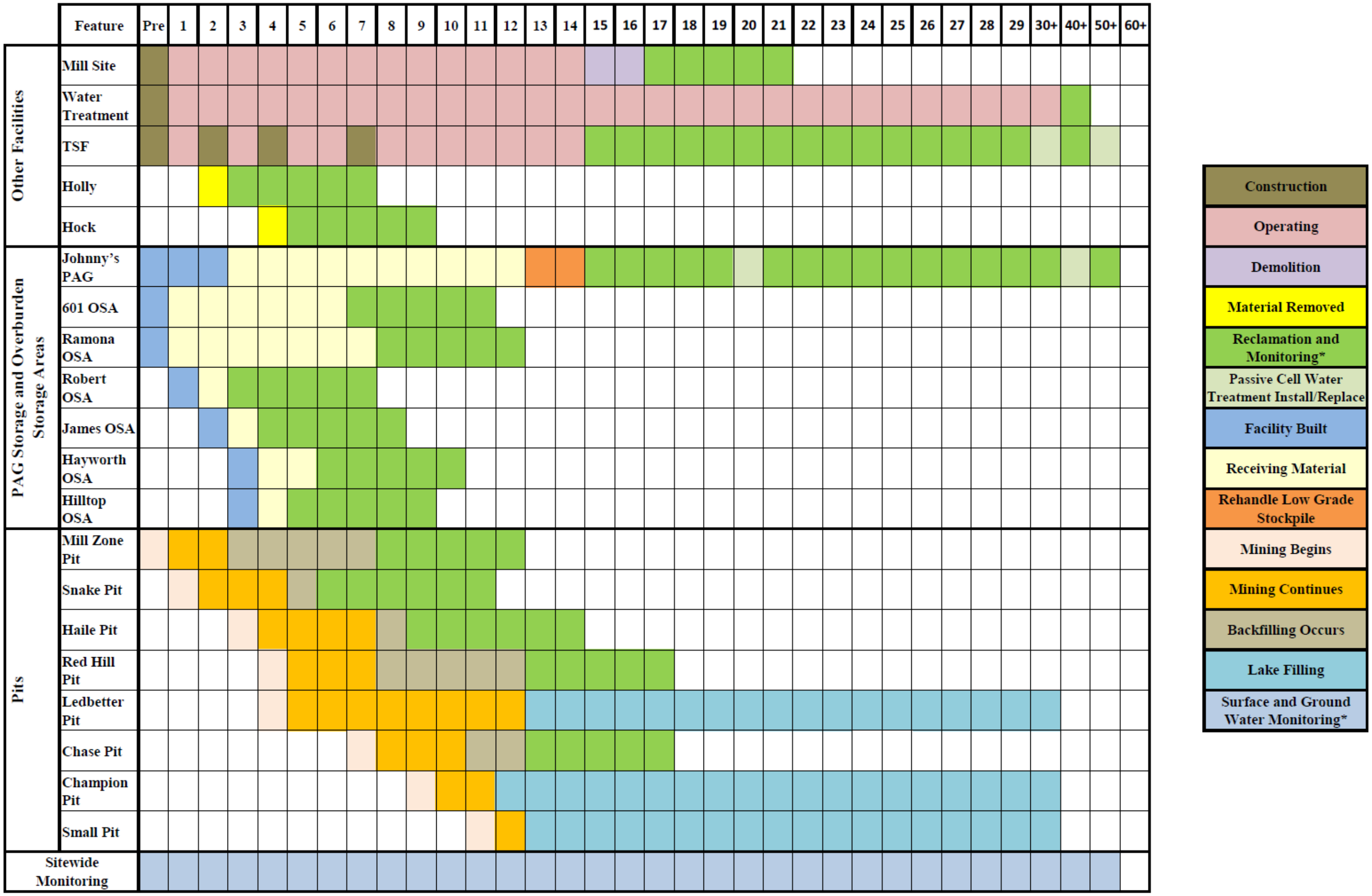
The Project would begin soon after all permits have been obtained and would occur in a planned sequence. The pre-production period involves construction of the Mill and other major mine components, with some limited mining of ore. After pre-production, active mining would move from pit to pit, with concurrent backfilling commencing when the initial pits have been mined out. During mining, high grade ore would be sent to the Mill, while low grade ore would be stockpiled at the potentially acid-generating (PAG) lined OSA site (Johnny's PAG) for later use. After active mining ceases, stockpiled low grade ore would be processed, and post-production reclamation would commence. Each part of mining includes activities and steps that proceed in a sequence, and some activities would occur concurrently at different locations on site. The order of mining is designed to maintain the steady supply of ore to the Mill. Figure A-6 illustrates the general order of pit development.

Table A-2 illustrates how overburden stripping, mining, pit backfilling, and reclamation would occur during the Project. The Project is proposed to last 15 years, counting the pre-production activities, 12 years of active mining (and some concurrent reclamation), and 2 years after mining has ended for low grade ore processing from stockpiles and additional reclamation. (Pre-production includes clearing, grubbing, and grading; facility construction; growth media and overburden removal and storage; and some ore mining, but no ore processing until the Mill is constructed.) As Table A-2 illustrates, overall site reclamation activities, water treatment, and monitoring and maintenance would continue after mining and ore processing has ended. Haile Gold Mine would require maintenance and monitoring at the end of mining and processing operations, as required by the South Carolina Department of Health and Environmental Control (SCDHEC). This would include monitoring surface water and groundwater for at least 10 years following the period when the pit lakes are filled and the TSF and Johnny's PAG are drained down. During this post-mining period, Haile expects to also perform periodic maintenance of drainage and treatment systems. (Refer to Section A.11, "Site Reclamation" for details.)

Table A-3 lists the tons mined per mine year of gold-bearing ore, low grade ore stored for later processing, and overburden. It also shows the total material to be mined per year.

[3] For Champion and Pit Lakes, "full" refers to 95 percent full because these pit lakes would be filled with groundwater and stormwater. For Ledbetter Pit Lake, "full" refers to 100 percent full.

Table A-2 Proposed General Mining Schedule for Pit Development and Site Reclamation



Note: For Champion and Small Pit Lakes, this is the time frame to reach 95 percent full.

* Period of monitoring would be in accordance with South Carolina Department of Health and Environmental Control regulations.

Source: Haile 2012a (table data revised in 2013).

Table A-3 Mine Production Schedule

Year	Ore (ktons)	Low Grade Ore (ktons)	Overburden (ktons)	Total Material Mined (ktons)
0	154	99	15,617	15,870
1	2,240	323	19,537	22,100
2	2,555	576	18,969	22,100
3	2,555	88	19,557	22,200
4	2,555	662	30,783	34,000
5	2,555	1,366	31,079	35,000
6	2,555	209	32,236	35,000
7	2,555	1,527	29,918	34,000
8	2,555	0	25,912	28,467
9	2,555	0	6,563	9,118
10	2,555	0	5,209	7,764
11	2,555	0	4,832	7,387
12a	836	0	1,128	1,964
Total	**28,780**	**4,850**	**241,340**	**274,970**

[a] Low grade ore from the stockpile would continue to be processed for 2+ years (Years 12, 13, and 14) after the active mining period. Total approximate low grade ore processed in Mine Year 12 would be 1,719 kilotons (ktons), in Mine Year 13 would be 2,555 ktons, and in Mine Year 14 would be 576 ktons. Slurry from processing of low grade ore would be sent to the TSF.

Source: Haile 2012a (table data revised in 2013).

A.4.2 Work Schedule and Personnel

Estimated numbers of personnel needed to operate and maintain mining equipment and facilities during the life of the Project are shown in Table A-4. These estimates are based on keeping the Mill continuously supplied with ore for the 14 years that ore would be processed. Shifts may vary over the life of the mine, but operations for the mine and the Mill would occur 24 hours per day, 365 days per year. Administrative personnel would work during the day shift. Table A-4 lists the estimated number of people by job class that would be employed during pre-production; at the peak of production in Mine Year 7; at the end of the mine life at Mine Year 14; and during post-mine life at Mine Years 15–18, 19–29, 30–40, 41–50, and 51-60.

A.5 Mining Methods and Facilities

A.5.1 Pit Development

Gold would be produced from ore located at various depths within the designated mining pits. The gold mineralized bedrock is overlain by growth media (including topsoil) that would be removed and stored for later reuse. Sand, clay, and heavily weathered bedrock (which together are called “overburden”) would be removed and stored. Generally, this material can be excavated without blasting and is removed using hydraulic shovels or wheel loaders and placed into 100-ton mining trucks. It would be transported to growth media storage areas or OSAs, or it would be used in construction of the TSF. Overburden generally is moved only once by truck: to an OSA, or to mined-out pits for backfill.

Table A-4 Project Personnel Estimates for Selected Years

Job Type	Number of Personnel							
	Pre-Production	Mine Year 7 (Peak)	Mine Year 14	Mine Years 15–18	Mine Years 19–29	Mine Years 30–40	Mine Years 41–50	Mine Years 51–60
Contract	366	78	0	20	2	2	2	2
Mine	174	256	63	3	2	0	0	0
Process	53	53	53	2	1	0	0	0
Administrative	37	37	37	4	2	1	1	1
Total	**628**	**424**	**153**	**29**	**7**	**3**	**3**	**3**

Note: “Pre-Production” includes facility construction, overburden stripping, and some ore production, but no ore processing.

Source: University of South Carolina 2012 (table data revised in 2013).

During the pre-production period, mining would begin with the Mill Zone Pit. During Mill Zone Pit mining, old tailings and overburden from past mining activities would be excavated and placed on the lined Johnny’s PAG.

Pit development follows engineering plans that optimize the size and shape of the pit to obtain the most ore and to minimize the amount of overburden that must be removed, considering operational safety and logistics. Mining within the pits progresses in levels, called *benches* where mining proceeds to a particular depth then expands the size of a bench and incorporates room to safely operate mining equipment and allow for access roads. Each bench of the mine pit is measured as a particular elevation. As the mine grows deeper, the benches resemble large steps. The height of each mining bench would be approximately 20 feet. The strength of the rock in the pit determines how steep the pit walls can be and still protect workers and equipment from wall instability. Access roads for equipment access and hauling overburden and ore would also be constructed in the pits.

Figure A-7 shows an open-pit mine in the western United States, with benches along the pit wall and a truck hauling rock up the access road. Figure A-8 is an example of a blasthole drill.

Blast holes would be drilled approximately 14 feet apart in a blast pattern of typically 50 and 200 holes (Haile 2010). The blast propagation is in a timed sequence in order to optimize rock fragmentation, minimize low-frequency vibrations, minimize fly rock, and protect the pit slopes from damage. The size of each blast, and the amount of explosive used in an individual blast, may vary depending on the rock characteristics and the geometry of the available room on a particular bench. Once an individual blast pattern has been drilled and the explosives are loaded, the pattern is blasted to fragment the rock for subsequent excavation (see Figure A-9).

Figure A-7 Example of an Open-Pit Mine

Notes: A truck is hauling ore up the access road. Benches are visible along the pit wall in the background, and a blasting pattern has been drilled on the level surface in the foreground, at the base of the pit.

Source: Newmont Mining Corporation 2012.

A.5.1 Mining Equipment

Hydraulic shovels and wheel loaders would then be used to remove the blasted material. Figure A-10 shows a hydraulic front shovel loading a haul truck, and Figure A-11 shows a wheeled loader in the center. The loading equipment would have a typical bucket capacity of approximately 15 cubic yards (cy) and would run on diesel fuel for 24 hours per day. The loading equipment would excavate material from the pits and load it into haul trucks for transport to the Mill, to OSAs, to pits for backfilling, or to growth media storage areas. The hydraulic shovel was selected for working in poor ground conditions that may impede the ability of a wheel loader to work efficiently. Wheel loaders were selected as they are highly mobile and can quickly move from one working area to another. Wheel loaders would excavate material in the pits and rehandle material in growth media storage areas and ore stockpiles, as well as in some OSAs.

Haulage equipment would consist of 100-ton capacity, off-road mining trucks (similar to that shown in Figure A-10). Articulated mining trucks, which bend in the middle, may be used from time to time where conditions warrant, such as in poor ground conditions. These trucks are smaller and have a capacity of approximately 25–40 tons. Equipment also is required to build and maintain pits, OSAs, haul roads, and growth media storage areas and to perform concurrent reclamation. The equipment used for support operations would consist of small loaders, small mining trucks, track dozers equipped with rippers, rubber-tire dozers, motor graders, water trucks, and hydraulic excavators. A track dozer, wheeled loader, and motor grader are shown in Figure A-11.

Figure A-8 Example of a Blasthole Drill

Source: Newmont Mining Corporation 2012.

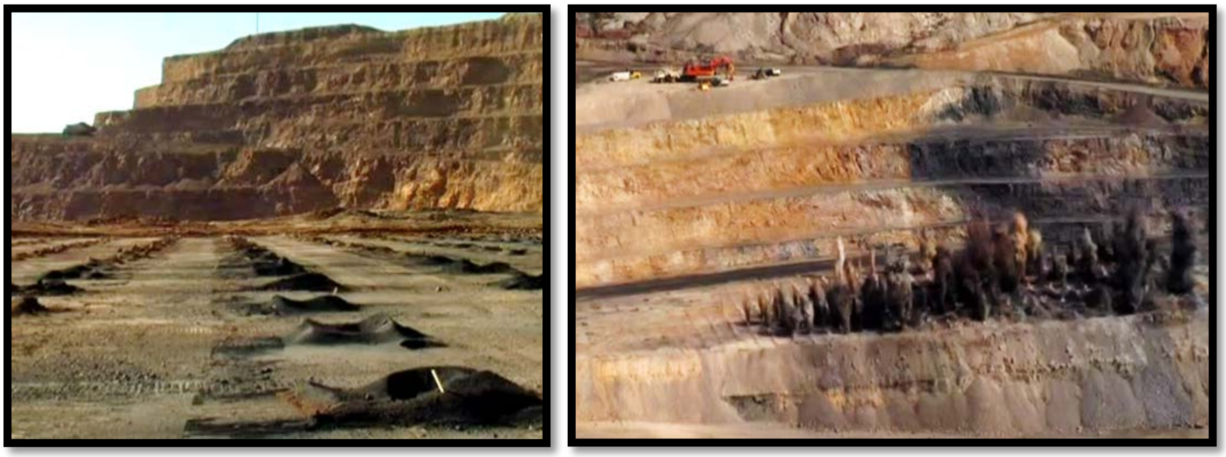


Figure A-9 Example of Drill Holes in a Blast Pattern and Blasting in a Timed Sequence

Note: The left image shows drill holes for blasting agents drilled in the bottom of an open mine pit. The right image shows active blasting in a timed sequence moving from right to left in the picture.

Source: Newmont Mining Corporation 2012.

Figure A-10 Example of a Hydraulic Shovel and Haul Truck

Source: Caterpillar 2012.

Figure A-11 Example of a Track Dozer (left and in background), Wheel Loader (center), and Motor Grader (far right)

Source: Romarco Minerals 2011.

Mining equipment would be selected to provide efficient operations within the pit design parameters. A schedule of required mine equipment is shown in Table A-5. During years of peak mining activity, major equipment requirements would be 24 haul trucks, five blasthole drills, and four track dozers, as well as the smaller support equipment mentioned above. As mining decreases after Mine Year 10, the number of haul trucks would be reduced to 12; most mining equipment no longer would be needed after Mine Year 14.

Table A-5 Major Mining Equipment

Equipment Type	Capacity or Model	Initial Number (Years 0–3)	Peak Number (Years 4–8)	Post Peak Number (Years 9–11)	Processing Low Grade (Years 12–14)
Blasthole drill	6 ½ inches	1–3	3–5	1–2	0
Hydraulic shovel	14.4 cubic yards	1	1	1	1
Wheel loader	15 cubic yards	1	1–2	1	1
Wheel loader	17 cubic yards	1	1	0	0
Haul truck	100 tons	11–12	17–24	6–7	1–2
Motor grader	14-foot blade	1	1	1	0
Motor grader	16-foot blade	1	1	1	1
Track dozer	410 horsepower	3	3	1	0
Track dozer	580 horsepower	0	1	1	1
Water truck	13,000 gallons	1–2	2	2	2
Rubber tire dozer	500 horsepower	1	1	1	1
Excavator	2 cubic yards	1	1	1	1
Compactor	160 horsepower	1	1	1	1

Note:

Different equipment with similar capacities and functions may be used, depending on cost and availability. Table A-5 includes only mining equipment; it does not include construction equipment leased by Haile or owned by contractors, which is shown in Table A-6.

Source: M3 Engineering & Technology 2010a (table data revised in 2013).

A.5.2 Earth-Moving, Geosynthetics, and Pipeline Construction Equipment

During initial construction of the TSF, Johnny's PAG, and the Mill Site, Haile would contract the major earthworks, geosynthetic installation, and pipeworks construction to contractors specializing in these construction work tasks. General activities for the initial construction would include the following:

- Installation of temporary erosion and sediment control features;
- Clearing, grubbing and removal of the growth media material and transporting it to the growth media storage area for later use at the TSF, Johnny's PAG, and Mill Site;
- Excavation of stormwater diversion channels, sediment detention channels, and basins;
- Excavation of construction material and equipment storage areas, haul and service access roads, and pipeline corridors and placement of safety berms;

- Rough grading and foundation preparation for the TSF and Johnny’s PAG sites;
- Mill foundation rough grading, excavation, placement, moisture conditioning, and compaction of structural fill;
- Excavation of groundwater drains and placement of drain pipe and drainage aggregate for the TSF and Johnny’s PAG;
- Transport and placement of soil materials, and moisture conditioning and compaction of the low-permeable soil liner material for the TSF and Johnny’s PAG;
- Transport and placement of soil materials, and moisture conditioning and compaction of the TSF embankment materials;
- Transport and placement of soil materials for the drainage aggregate and geosynthetic liner protective layer for the TSF and Johnny’s PAG; and
- Final grading for the Mill Site.

The earthworks equipment fleet would consist of scraper and track-type tractors and hydraulic excavators to excavate various materials. Wheel loaders would load the growth media, low-permeability soil liner, and embankment material into haul trucks that transport materials to respective growth media storage areas, the TSF, Johnny’s PAG, and the Mill Site.

Water trucks would transport water for soil moisture conditioning and dust control. Earth-moving equipment would consist of 100-ton-capacity, off-road mining trucks (similar to that shown in Figure A-10). Articulated mining trucks (25- to 40-ton capacity) that bend in the middle would be used in confined areas that preclude mine haul truck operations and where smaller equipment is required to place materials on geosynthetic liners. Wheel-loaders and integrated tool carriers would be used to transport and deploy the geosynthetic lining. Additional equipment that is required in support of earthwork construction would consist of small loaders, rubber-tire tractors, motor graders, and vibratory compaction equipment. The earthworks construction equipment would run on diesel fuel and operate up to 24 hours per day.

Construction activities to be completed during Pre-Production would include the starter embankment stage for the TSF, initial construction of Johnny’s PAG, and the entire Mill Site earthwork. The final buildout to Johnny’s PAG would be constructed in Mine Year 2. Later embankment stage construction for the TSF would occur in Mine Years 2, 4, and 7. A general schedule of required major equipment for earthmoving, geosynthetics, and pipeline construction is shown in Table A-6.

Table A-6 Major Earth-Moving, Geosynthetics, and Pipeline Construction Equipment

Equipment Type	Capacity or Model	TSF, Johnny's PAG, and Mill Site (Mine Years 0–1)	Johnny's PAG Buildout (Mine Year 2)	TSF Stage Construction (Mine Years 2, 4, and 7)
Scraper	22–34 yards	8–10	4	4–6
Large track-type tractor	310–580 horsepower	6–8	3–4	4
Medium track-type tractor	125–235 horsepower	3–5	2	3
Wheel loader	3.6–6.5 yards	4–8	2	2–4
Wheel loader – integrated tool carrier	6.5–7 yards	3–5	1	2
Haul truck	100 tons	6–8	3–4	5–12
Articulated haul truck	26–42 tons	11–12	6–8	3–6
Motor grader	14- to 16-foot blade	4	2	2
Hydraulic excavator	380 horsepower	3–4	2	2
Hydraulic excavator	148 horsepower	8–10	3–4	4
Backhoe	102 horsepower	3	2	2
Water trucks	5,000–13,000 gallons	8–10	3–4	4–5
Soil compactor	232–345 horsepower	6–8	3	4–5
Vibratory soil compactor	83–100 horsepower	4–5	2	3
Tandem vibratory roller	83–130 horsepower	4–5	1	2

Note: Different equipment with similar capacities and functions may be used, depending on the contractor's equipment fleet.

Source: Haile 2013a.

A.5.3 Access, Roads, and Highway Crossings

A.5.3.1 Main Entrance at US Highway 601

Currently, the main access to Haile Gold Mine is off SR 188 (Haile Road), which intersects with US 601 approximately 3 miles north of the Town of Kershaw. This access point would be abandoned in favor of an access off US 601 at the existing Snowy Owl Road, which is approximately 2 miles further north on US 601. The intersection of Snowy Owl Road and US 601 would be improved (Figure A-12) to include a left-turn lane for southbound US 601 traffic onto Snowy Owl Road and a right-deceleration and turn lane in the northbound direction of US 601 onto Snowy Owl Road. Employees, visitors, and delivery vehicles would use this intersection to access the mine. Snowy Owl Road would be improved for a distance of 200–300 feet, to allow vehicles turning right (northbound) from Snowy Owl Road onto US 601 to proceed without being held up by vehicles turning left (southbound). Once heavy truck traffic has turned off US 601, it would be directed off Snowy Owl Road onto an improved gravel road to the Guard House and weigh scales. This would keep heavy trucks separated from the lighter vehicles. Light vehicles would continue on Snowy Owl Road to the Guard House. Personnel in the Guard House would sign in all trucks and light vehicles, thereby controlling entrance to the mine. The Guard House personnel also would direct the vehicles to their appropriate destination. If necessary, visitors would be escorted from the Guard House to the correct location.

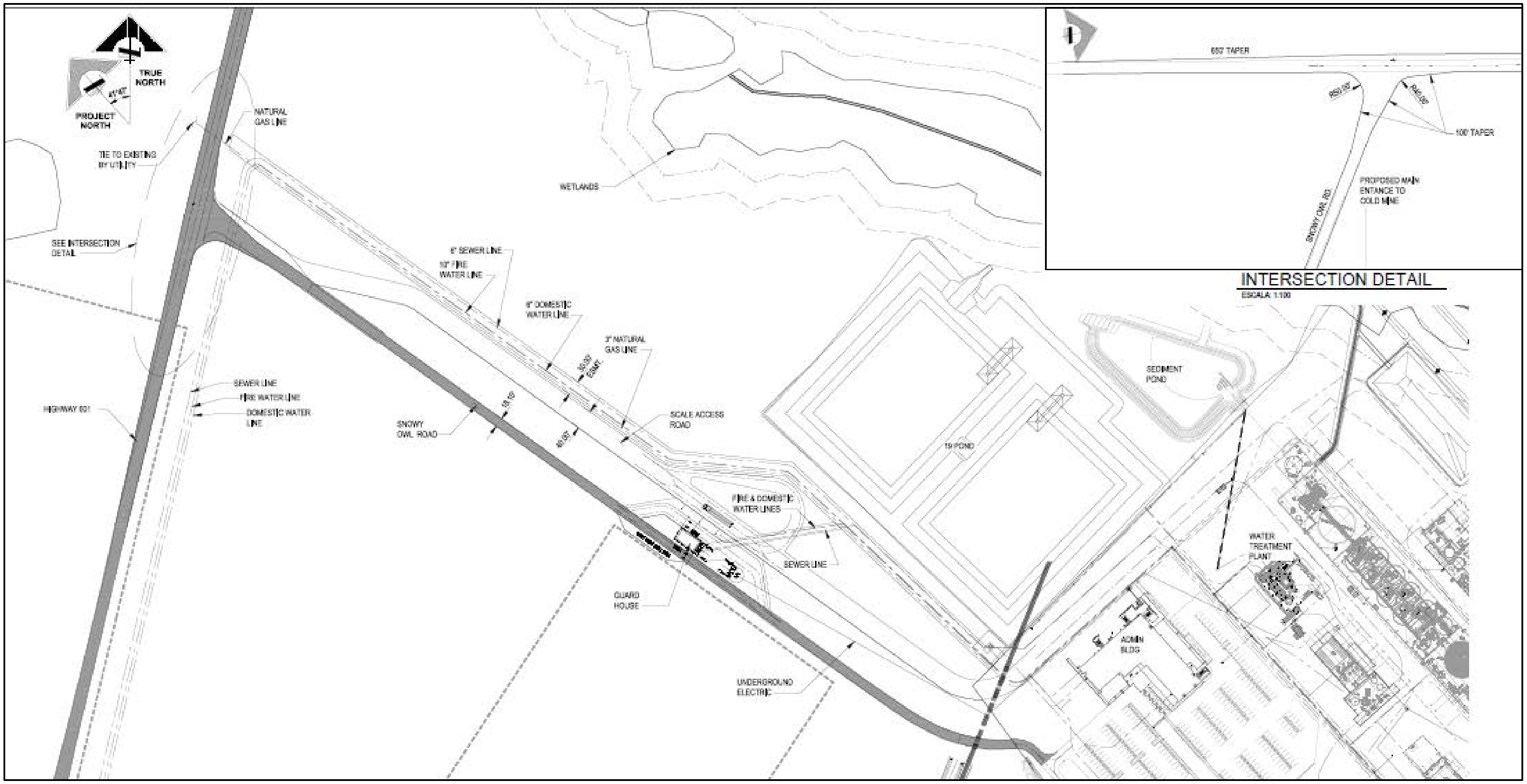


Figure A-12 US Highway 601 and Snowy Owl Road Interchange

Source: Haile 2013a.

A.5.3.2 Tailings Storage Facility Overpass on US Highway 601

The TSF would be accessed via an improved dirt road from the Mill Site. The design of this road is very similar to the mine haul roads because at times it would be used to haul TSF construction materials from the mine to the TSF or to a growth media storage area. The more common use, however, would be for the daily trips by light vehicles from the Mill Site to the TSF. To avoid disrupting traffic flow along US 601, an overpass is planned over US 601 that is capable of supporting a fully loaded 150-ton class haul truck. This overpass, that would be designed for one-way traffic only, also would have a section dedicated to carrying the tailings delivery and the tailings reclaim water pipelines. A concrete barrier would separate the pipe corridor from the vehicle traffic lanes.

The overpass also would be designed with a safety barricade to prevent debris from falling from the overpass. Only mine personnel would have access to this overpass. Figure A-13 depicts the general layout of the overpass—a long section of the overpass perpendicular to US 601, and a short section of the overpass showing a truck and the pipelines.

A.5.3.3 Champion Pit Overpass on US Highway 601

Approximately 9 years after the mine commences operations, mining of the Champion Pit is scheduled to begin. The Champion Pit is on the west side of US 601, making it necessary to haul the ore to the east side of the road. To avoid disrupting traffic on US 601, Haile would install an overpass of similar design as the TSF overpass to cross US 601 at the intersection of US 601 and the Champion Pit haul road.

A.5.3.4 Mine Haul Roads

Haul roads would be used throughout the mine to connect various facilities. Light vehicles, haul trucks, and other mobile mine equipment would use the haul roads to gain access to various facilities for appropriate work. The primary use of the haul roads would be for mine haul trucks to deliver ore and overburden to the appropriate destinations. Roads would be constructed from each active pit to the appropriate OSA, Johnny's PAG, and the Mill Site. There would also be two haul roads from the Mill Site: one to the TSF and one to the mine maintenance shop, fuel station, and truck wash area. Left-hand traffic would be used on all mine haul roads. These haul roads would be constructed from mined materials, and fugitive dust would be controlled with water trucks. Haul roads would be approximately 100 feet wide, including safety berms and drainage ditches. The maximum haul road design gradient is 10 percent. Figure A-14 illustrates a typical mine haul road cross section.

In addition, several service roads (dirt or gravel, typically 15–30 feet wide) for light vehicles would be used primarily by process operators and maintenance personnel to move about the mine site. One such service road would go from the north end of the Mill Site to the southern areas. This road would roughly follow the utility corridor from the Mill Site to the Mill Zone Pit area. This service road on the west side of Johnny's PAG would access the Utility Pond, 469 Collection Pond, contact water treatment plant discharge point, and other facilities. The service roads would be used by light vehicles to access other areas of the mine for operations and maintenance.

Within the Mill Site, only a few small travel ways would be designated for light vehicles and delivery trucks. These travel ways would generally follow each side of the Mill. One segment of the service road would branch off and go to the warehouse and truck shop building and the fuel station. Figure A-15 illustrates a typical mine service road cross section.

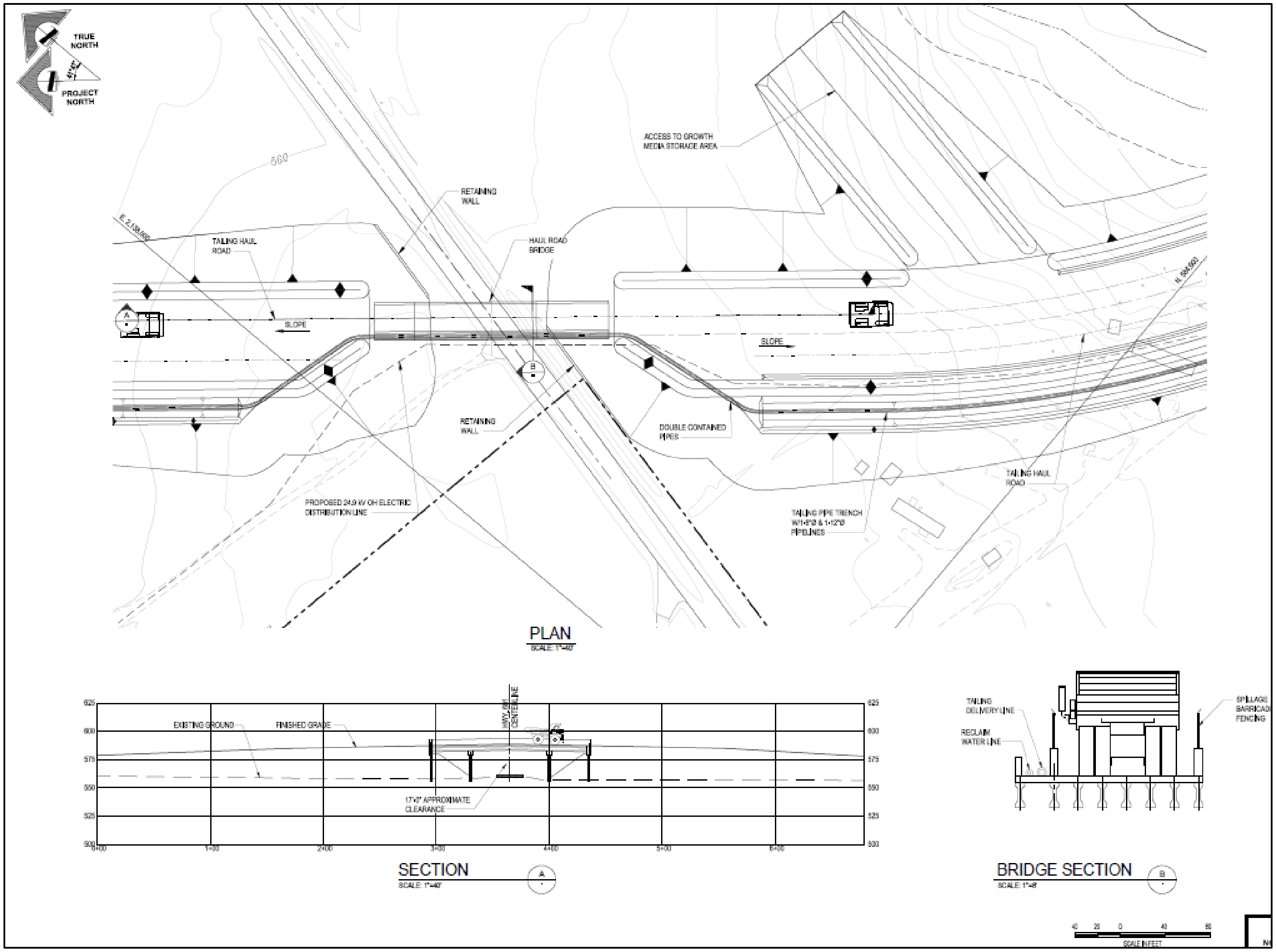


Figure A-13 General Layout of US Highway 601 Overpass

Source: Haile 2013a.

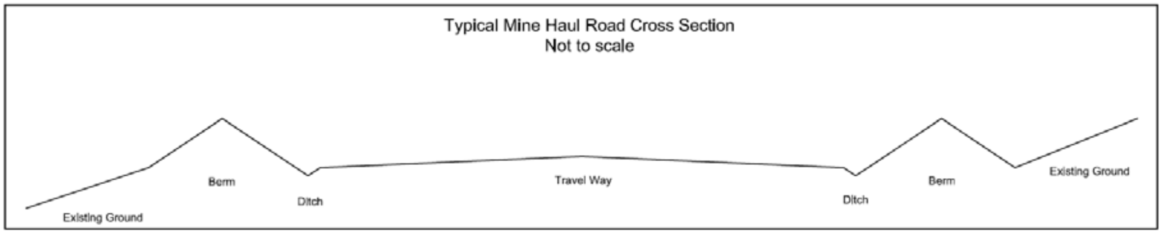


Figure A-14 Typical Mine Haul Road Cross Section

Source: Haile 2013.

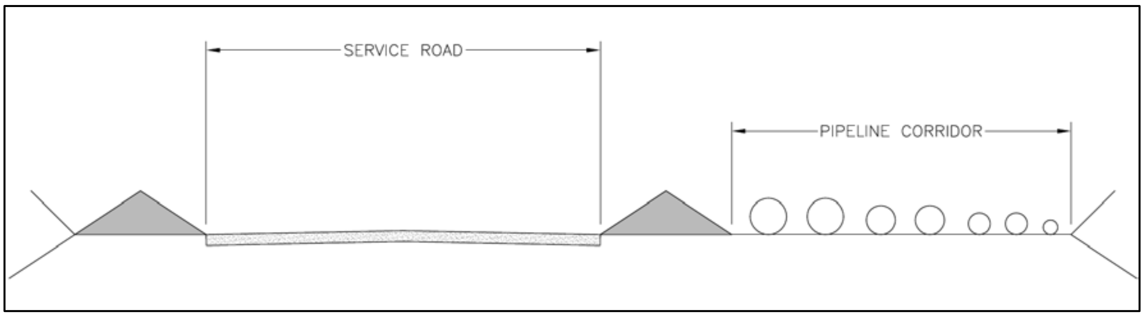


Figure A-15 Typical Mine Service Road Cross Section

Note:

Pipeline corridors would be adjacent to some service roads, as shown in this figure.

Source: Haile 2013a.

Figure A-16 shows the accumulation of mine roads that would be developed over the course of the mine. To see the haul roads used at a given point in the mine life, see the year-to year maps of the mine provided in the Haile Anticipated Mine Production and Operations Report (Haile 2012a). Note that Figure A-16 does not depict mine roads related to pit operations where pit development eventually would consume the haul road.

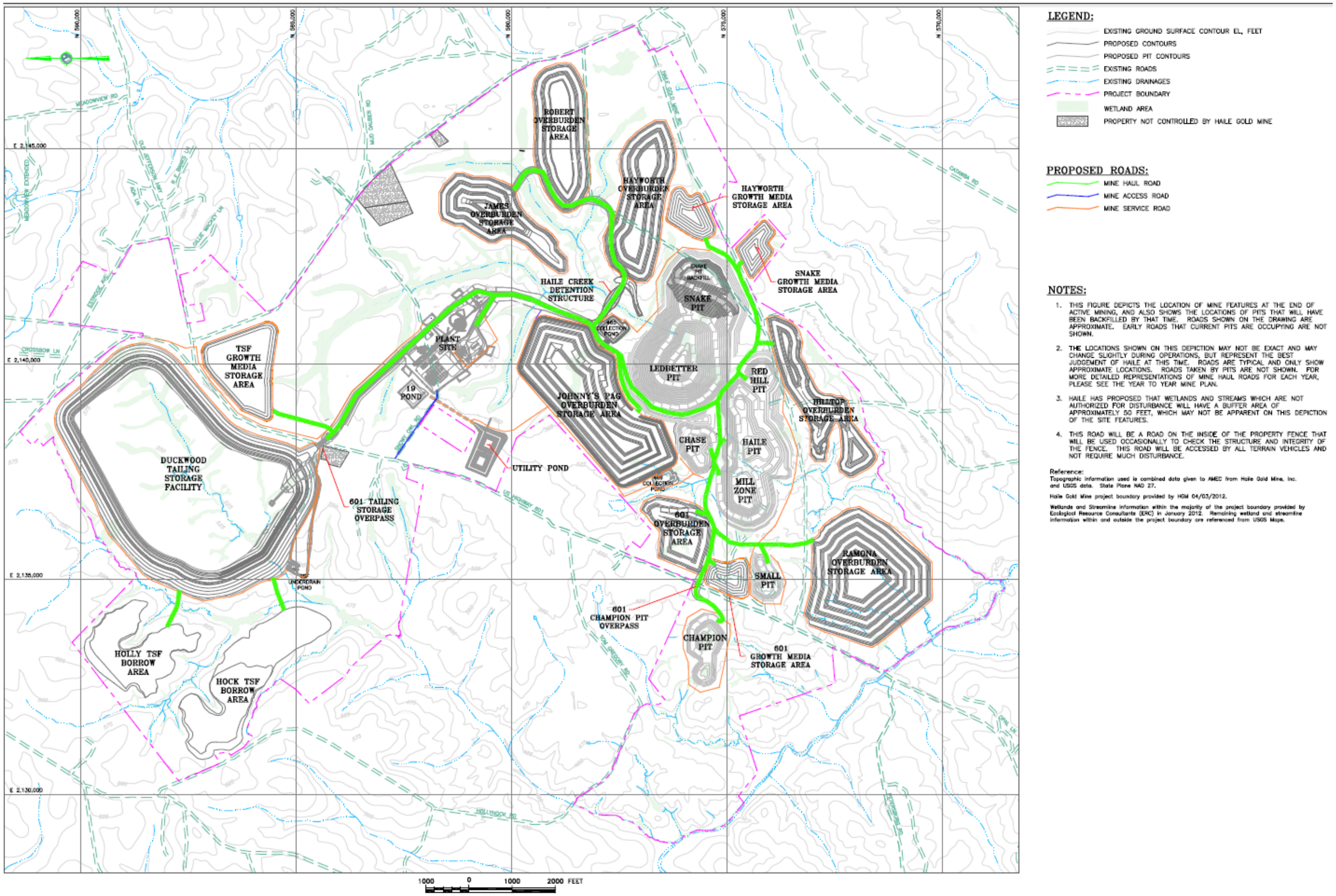


Figure A-16 General Location of Mine Roads

Source: Haile 2013a.

A.5.3.5 Road Closings

Haile has petitioned for closure of 17 abandoned but not formally closed Lancaster County roads and closure of three open Lancaster County roads: Snowy Owl, Gene Lewellen, and Bumblebee (aka Gary Road). The planned closure of Snowy Owl Road, for which Haile owns or controls all tracts of land along the roadway, is not expected to affect access to private roadways or existing land uses along the road. The planned closure of the Gene Lewellen dirt road through the mine area, where Haile owns all tracts of land along the roadway, is not expected to affect access to private roadways or existing land uses. The planned closure of a segment of the Bumblebee dirt road that intersects State Road (SR) 188 and traverses the Haile Gold Mine property is not expected to affect access to private roadways or existing land uses. The Bumblebee dirt road extends to the south, where it intersects SR 157. From SR 157, access is provided to private roadways and existing uses. Lancaster County road closures would be performed in accordance with county regulation, under which the appropriate public involvement process is afforded to interested parties.

Haile intends to apply for closure of SR 188 (Haile Gold Mine Road) through the mine area, where Haile owns or controls the tracts of land; where Haile does not own or control tracts of land, it would cul-de-sac SR 188 to ensure access to private roadways. At the intersection of US 601, SR 188 heads northeast, where it intersects SR 265. The closure of SR 188 from the intersection with US 601 and extending northeast through Haile-owned or -controlled property is not expected to affect access to private roadways or existing land uses along the closed segment of road. Access along any unclosed segment of SR 188 where Haile does not own or control the tract of land would still be provided via the intersection of SR 188 and County Road 219. State road closure would be performed in accordance with state and local regulation, under which the appropriate public involvement process is afforded to interested parties. Figure A-17 shows roads designated for closure.

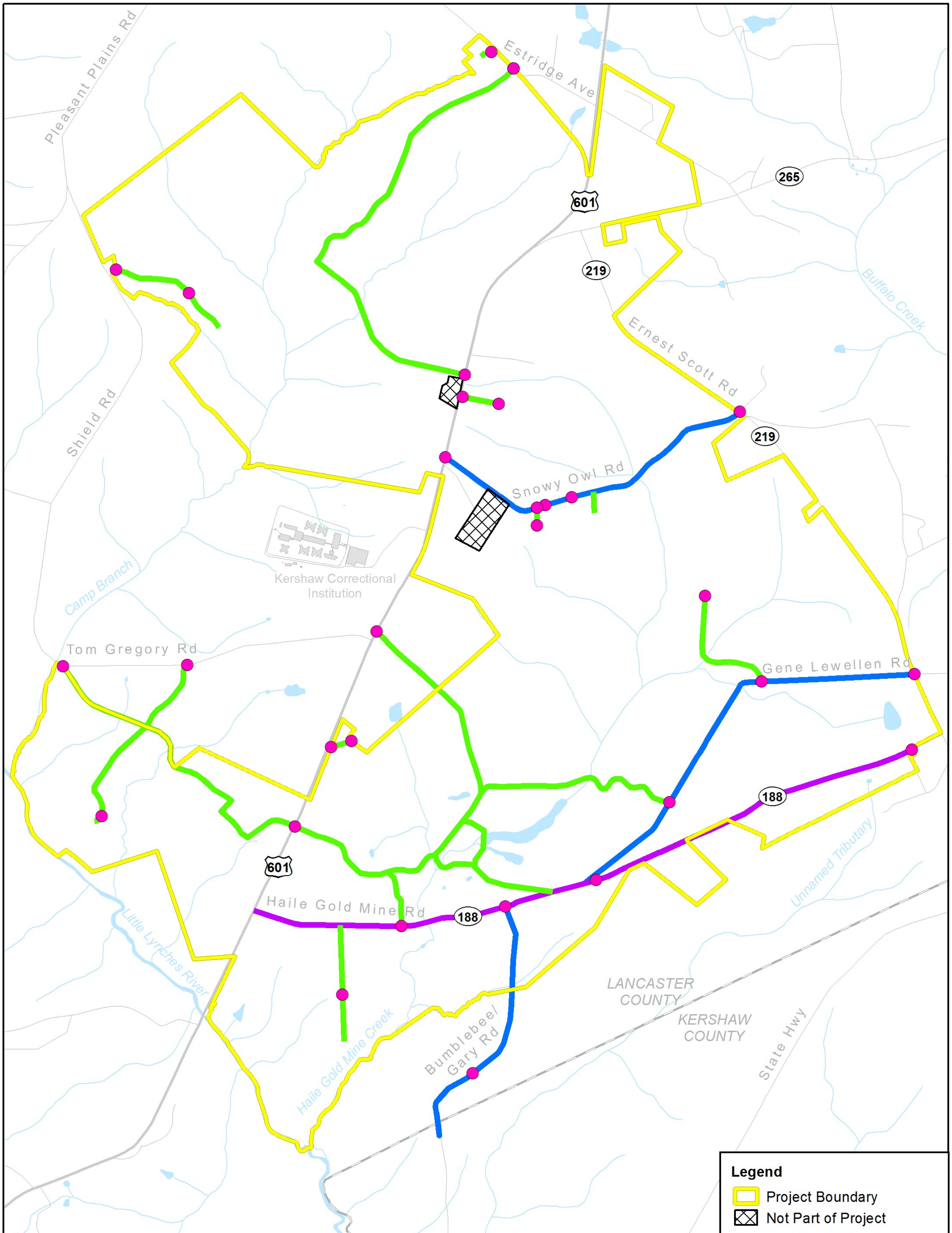
A.5.3.6 Road Construction

Haul roads would be constructed using mined materials placed and maintained by mine personnel and equipment. The gravel (wear surface) used on the haul roads would be generated on site by crushing mined material. Crushed material would need to be available for new haul road and service road construction and for road maintenance, as long as the mine trucks are in operation. Initially, 100,000 tons per year would be required, and this quantity would fluctuate depending on haul requirements and the condition of the roads.

A.6 Overburden Storage Areas and Growth Media Storage Areas

Prior to the start of mining, the growth media would be removed from the pit areas, Johnny’s PAG, and the TSF and stored in designated storage areas (“growth media storage areas”) for later use in reclamation and stabilizing storage sites (OSAs, Johnny’s PAG, and the TSF). The growth media would be stored in the four growth media storage areas shown in Figure A-2.

Overburden material would be stored or used onsite. During mine operations, the various OSAs would be used to store approximately162 million tons, or 67 percent of the overburden material generated from digging the pits. Approximately 67 millon tons, or 28 percent of the overburden, would be backfilled in mined-out pits. Another 12 million tons of overburden, or 5 percent of the overburden, would be used for TSF construction.



Haile Gold Mine Environmental Impact Statement
www.HaileGoldMineEIS.com

Figure A-17

Roads Subject to Closure Proceedings

0 1,000 2,000 Feet
0 300 600 Meters

Sources: ESRI 2008, Haile 2013a.

The overburden material mined in the pits would be classified as potentially acid-generating (PAG) or not potentially acid-generating (non-PAG) overburden, depending on the amount of acid-generating minerals that occur in the rock.[4] Overburden would be tested and classified during ore control sampling (each blasthole drilled would have a sample of the drill cuttings assayed for sulfur and gold) into the following categories based on its acid-generating potential:

- PAG (Red Class) – greater than 1 percent pyritic sulfur
- Moderate PAG (Yellow Class) – between 0.2 and 1 percent pyritic sulfur
- Non-PAG (Green Class) – less than 0.2 percent pyritic sulfur

Figure A-18 illustrates the expected cumulative overburden production by PAG class from Years 1 through 12 of the mine operations. The material classified as Red Class overburden would be stored exclusively within the OSA known as Johnny's PAG, a facility that would be lined with a high-density polyethylene (HDPE) liner. The Yellow Class overburden would be stored at Johnny's PAG or used for backfilling pits (see Section A.11.1, "Backfilled Pits" for details). The other six OSAs (601, Ramona, Hayworth, Robert, Hilltop, and James) would receive Green Class overburden. The OSAs would be constructed and managed as the open pits are developed (see Section A.4, "Project Sequence" for details).

Table A-7 provides details of the types and amounts of material that would be stored in each OSA, and the estimated final capacity of each OSA.

Any water that comes in contact with the Red and Yellow Class overburden material on Johnny's PAG is managed as *contact water*, meaning that it is water that has come in contact with PAG material and cannot be discharged to surface waters without treatment. Johnny's PAG would be constructed with an 80-mil (a mil is one one-thousandth of an inch) HDPE geomembrane liner underlain with low-permeability soils in order to contain and route seepage and runoff waters to two collection ponds (the 465 and 469 Collection Ponds) for water treatment. *Seepage* is water that may collect within the stored material and seep to the collection system above the HDPE liner. *Runoff* is rain water that may land on the stored material and run off the surface. See Figure A-19 for a cross section of the Johnny's PAG underdrain collection system. Collection channels are built within the HDPE-lined facility and surround Johnny's PAG to divert untreated surface runoff and seepage from the PAG to HDPE-lined collection ponds that have been sized to capture the 100-year 24-hour precipitation event. The *100-year 24-hour precipitation event* is defined by the American Meteorological Society as, "the storm precipitation that has a 1 percent chance of being equaled or exceeded in a 24-hour duration during a given year" (AMS 1959). The 100-year 24-hour event for the Project site is calculated as 8.59 inches. This contact stormwater runoff and seepage would be used in the Mill or treated at the contact water treatment plant (see Section A.9, "Surface Water Management" for details). Contact water would not be released to the environment without treatment.

4 *Acid-generating potential* refers to a material's potential to generate acid and produce acid rock drainage. *Acid rock drainage* is produced by the oxidation of sulfide minerals, chiefly iron pyrite or iron disulfide (FeS2). Ferrous iron can be further oxidized, producing additional acidity. This is a natural chemical reaction when minerals are exposed to air and water that produces acidity and dissolves metals in water; however, it can impair water quality. Acid rock drainage can mobilize and transport the heavy meals that occur in metal deposits. *Acid mine drainage* is the outflow of water from mines, underground workings, waste rock, and tailings after sulfide minerals have been exposed to air and water, oxidizing metal sulfides (often pyrite, which is iron-sulfide) within the surrounding rock and overburden.

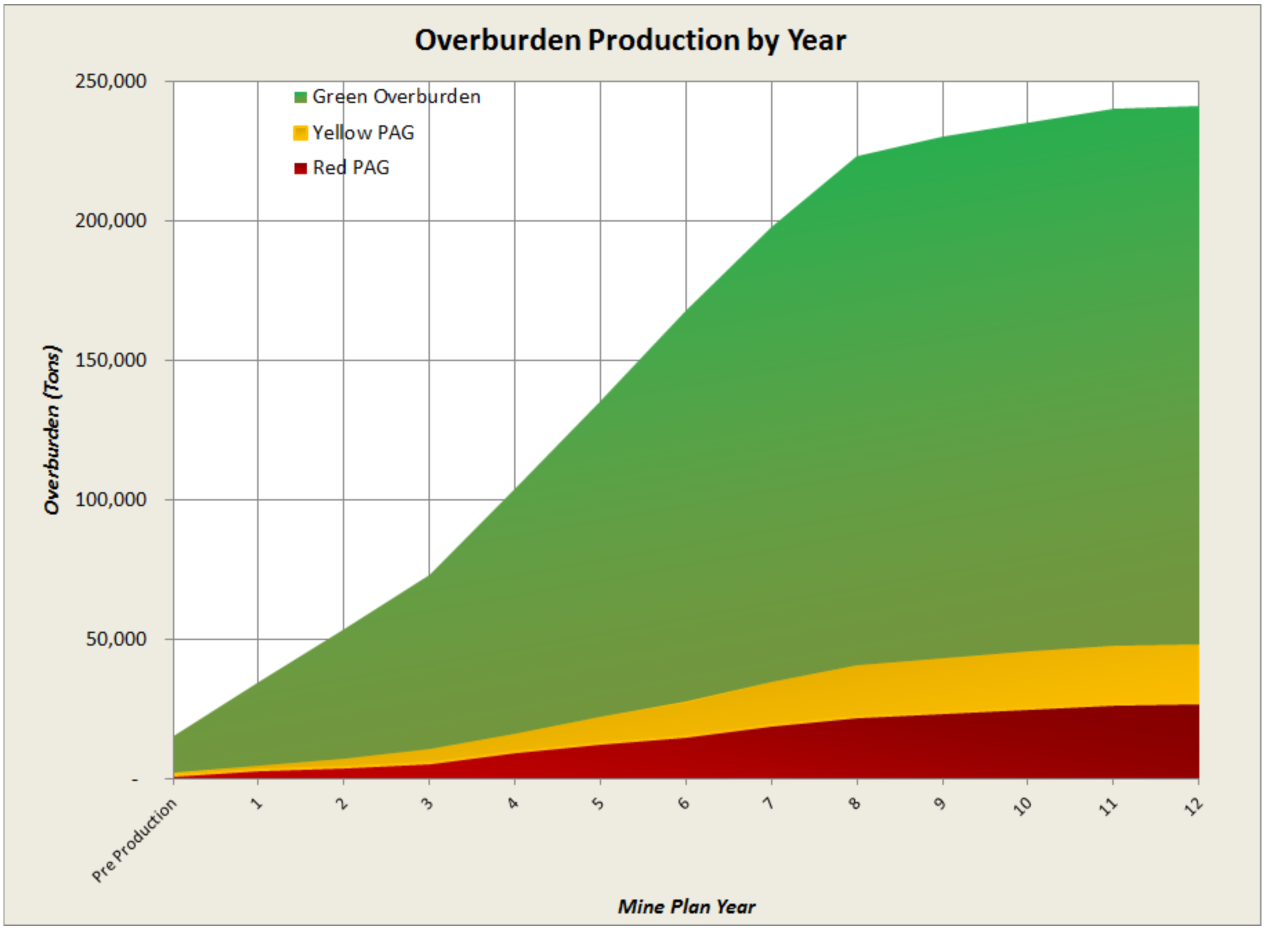


Figure A-18 Cumulative Overburden Production by Potential Acid Generation Class

Note:

The actual mix of overburden "classes" may change slightly based on additional testing and during operations, but the data to date indicate that the types of overburden are in these ranges and in these relative proportions.

Source: Schafer 2012.

Groundwater would be routed under Johnny's PAG to avoid contact via collection pipes that would be installed below the low-permeability soil liner. Groundwater would be routed to a tributary of Haile Gold Mine Creek. See Figure A-19 for a typical cross section of the groundwater drain piping placed below the low-permeability soil liner.

The ultimate footprint of Johnny's PAG would be approximately 159 acres. The overburden material placed within the limits of Johnny's PAG would be constructed with an overall slope of 3:1 (horizontal: vertical) and built to a maximum toe–to-crest height of approximately 250 feet.

All of the Green Class OSAs would be developed with 3:1 side slopes. Channels to collect stormwater and sediment would be constructed around the footprint of each OSA (see the example provided in Figure A-20).

Table A-7 Overburden and Growth Media Storage Area Characteristics

Overburden Storage Area	Potential Acid Generation Class	Year Initiated (year)	Reclamation Completed (year)	Maximum Capacity (million tons)	Estimated Final Capacitya (million tons)	Base Footprint (acres)b
Johnny's PAG	Red/Yellow	Pre-production	14	46.3	41.4[c]	159
601	Green	Pre-production	8	7.2	Pre-production	42
Ramona	Green	Pre-production	8	57.8	52.1	150
Hayworth	Green	3	6	21.3	20.8	86
Hilltop	Green	3	7	12.6	12.1	63
James	Green	2	4	17.8	17.8	66
Robert	Green	1	3	14.8	14.8	81
Pit backfill	Yellow/Green	3	12	66.7	66.7	N/A
TSF growth media	Green	Pre-production	14	3.3	Pre-production	56
601 growth media	Green	Pre-production	14	1.2	Pre-production	15
Snake growth media	Green	1	14	1.0	Pre-production	13
Hayworth growth media	Green	1	14	1.5	Pre-production	19

Notes:

a Some of the material placed in OSAs would be used for backfill or construction of the TSF or Haile Gold Mine Creek detention structure. The 601 OSA would be used to store material for the first 7 years, but its material would be completely used as backfill or in the TSF construction.

b Does not include the acreage for roads or stormwater sediment control. This accounts for the discrepancy in the total acreage number between Tables A-1 and A-7, as Table A-1 does include acreage for roads and stormwater sediment.

c 4.9 million tons of low grade ore processed.

Source: M3 Engineering & Technology 2010a (Table data revised in 2013).

Sediment control structures would be constructed at the outfall of the stormwater runoff control channels for each facility. After the sediment settles out, water retained within the ponds would be discharged to an adjacent drainage, consistent with Haile's NPDES General Permit for Stormwater Discharges Associated with Industrial Activities (Except Construction) regulated by the SCDHEC, Bureau of Water, Stormwater Permitting Section (Haile's Industrial General Permit). The sediment also would be managed in accordance these standards.

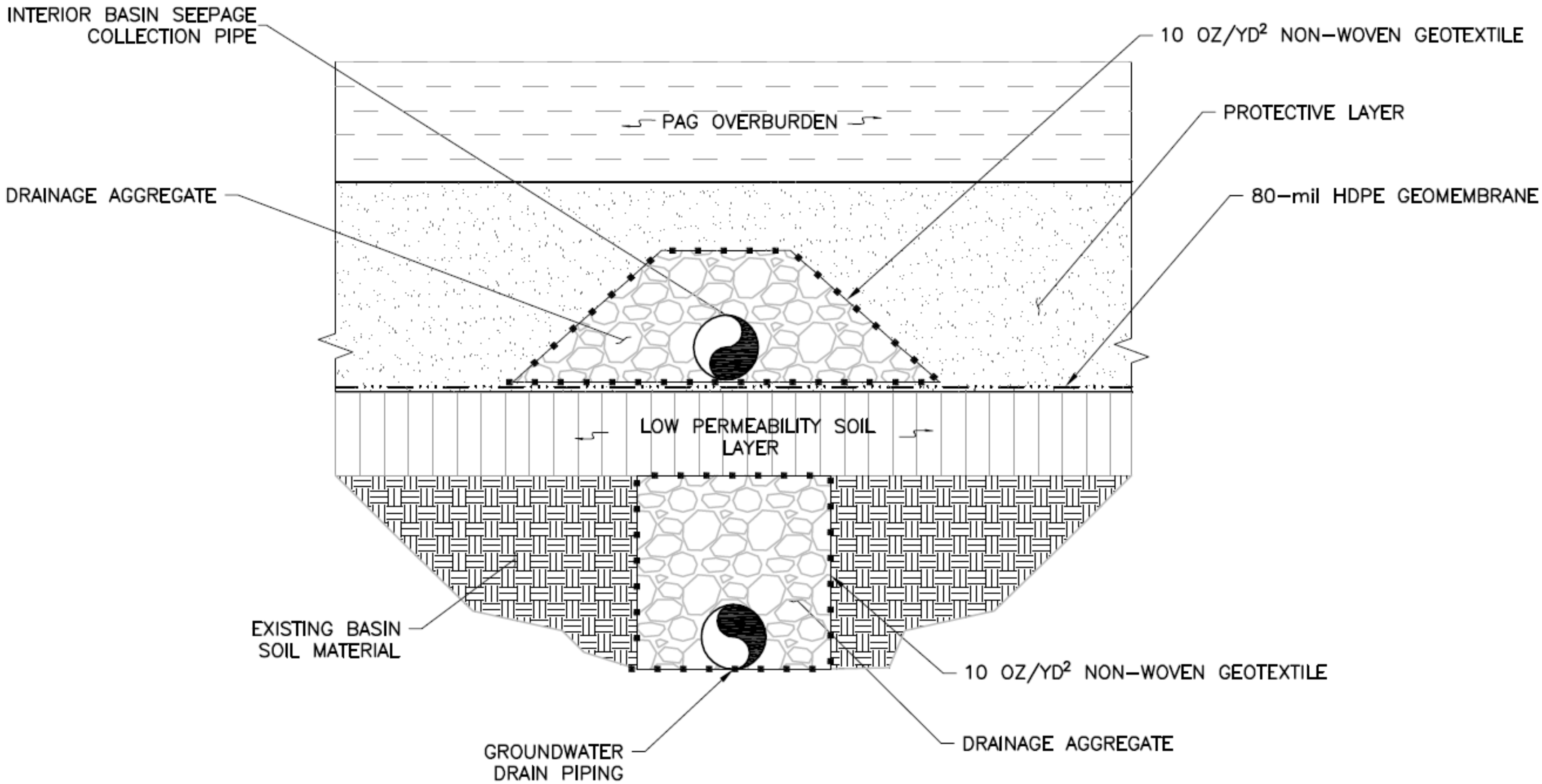


Figure A-19 Cross Section of Johnny's PAG Groundwater Drain and Seepage Collection System

Source: Haile 2013a.

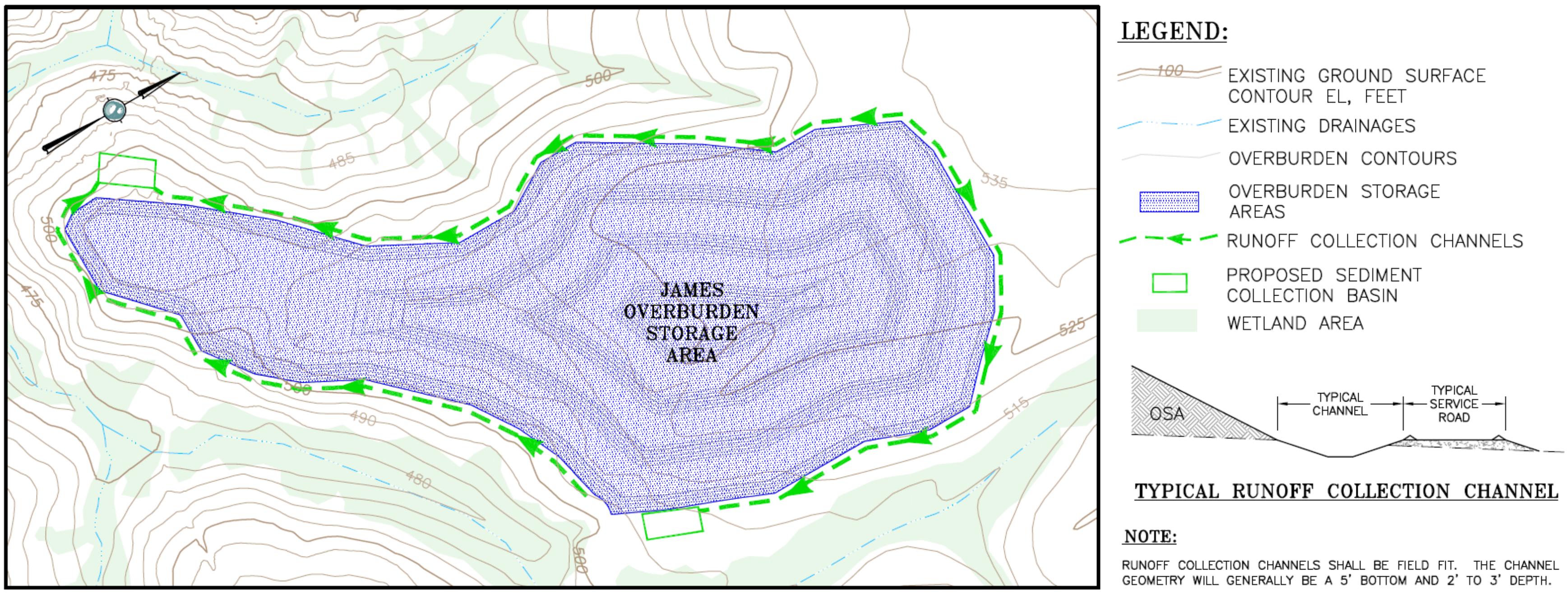


Figure A-20 Example of an Overburden Storage Area with Runoff Collection Channels and Sediment Collection Basins

Source: Haile 2013a.

A.7 Ore Processing Methods and Facilities

This section generally describes how the ore is processed to remove the gold. More detail can be found in the *Supplemental Analysis to the Mill Process Description and Process Flow Sheet* (M3 Engineering & Technology 2012a).

Gold-bearing ore would be sent to the Mill, where it would go through a process of physical size reduction and chemical separation to extract the precious metals. The Mill Site is located on a 103-acre portion of the mine that includes the Mill and ancillary support facilities, such as reagent storage and mixing, contact water treatment plant, water storage tanks, containment systems, 19 Pond, fuel storage (diesel fuel and gasoline), maintenance shops, truck wash, warehouse, administrative offices, and parking. (The 184-acre number used in Table A-1, "Mill, associated ore storage and support facilities, and haul roads," includes the acreage for the Utility Pond, the haul road to the TSF, and various service roads related to the Mill Site). Figure A-21 shows a site plan of the Mill and its support facilities. The Mill Site would be prepared by grading and leveling portions of the existing surface, and would include stormwater and sediment management features as indicated in Figure A-21. Some areas would be left at existing grade. Figure A-22 is a three-dimensional rendering of the Mill Site based on engineering drawings.

The gold processing facility incorporates both physical and chemical separation techniques to remove the gold from the ore. Figure A-23 presents the general Mill process flow sheet.

The following steps summarize the process for extracting the gold from the ore (colors refer to those shown in the figure):

- Primary Crushing (brown) – The ore would be crushed to less than 6 inches by the primary crusher.
- Grinding (SAG and Ball Mill) (blue) – The less than 6-inch rock would be ground in water to the size of a fine powder, approximately 74 microns in size, or about the grain size of table salt. The mixture of particles and water is called *slurry*, and the process from this point on is in slurry form.
- Flotation (red) – The slurry from grinding would be treated with chemicals to enable the gold-bearing minerals to float to the top of the flotation machines (flash flotation cell and rougher flotation) and concentrate as a froth. The froth would flow downstream as a slurry concentrate for further processing in the regrind circuit (described next). The ore that does not float in this process is called *flotation tailing*, and flotation tailing would be pumped to the carbon-in-leach (CIL) circuit described below.
- Regrind (red) – The slurry concentrate of gold-bearing minerals from flotation would be ground further to approximately 13 microns in size, about the grain size of talcum powder, in the six regrind mills.
- Carbon in Leach (green) – The CIL process would take place in eight tanks. The reground concentrate slurry would be oxidized with air in the pre-aeration tank prior to being treated with sodium cyanide in CIL Tank No. 1. Dissolved gold would be adsorbed onto activated carbon. The discharge from CIL Tank No. 1 would flow by gravity to CIL Tank No. 2, where it would combine with the flotation tailing. The combined streams would be treated with sodium cyanide, and the dissolved gold would be adsorbed onto activated carbon in CIL Tanks Nos. 2 through 8. The discharge from CIL Tank No. 8 would be thickened, and most of the sodium cyanide would be returned to the concentrate treatment stage. Under normal operating conditions, the remaining flow would be pumped to the TSF. If the cyanide level is greater than or equal to 50 ppm WAD cyanide, the flow would be directed to the cyanide destruction tanks, where cyanide would be destroyed using a sulfur dioxide and air process.

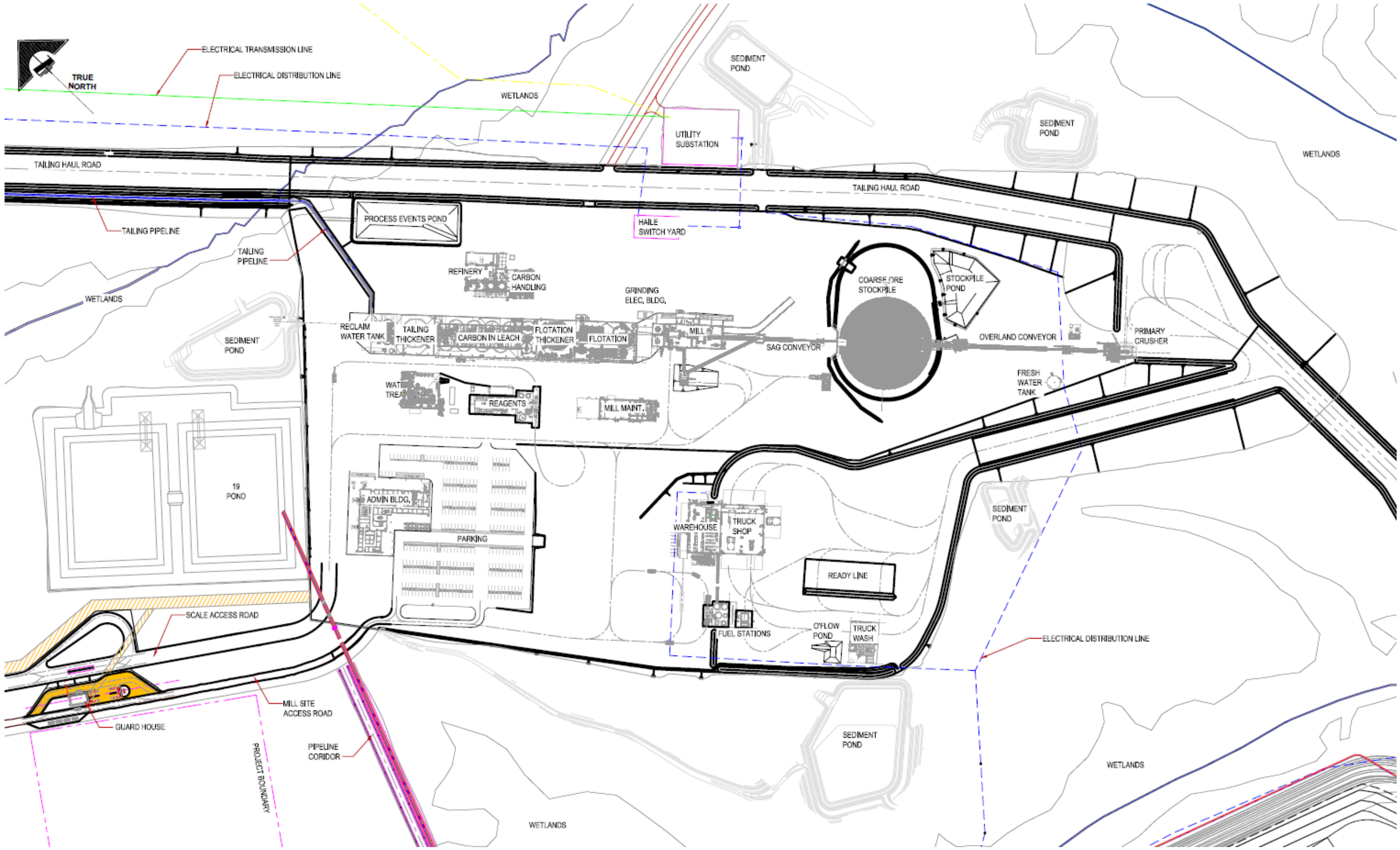


Figure A-21 Mill Site Plan

Source: Haile 2013a.

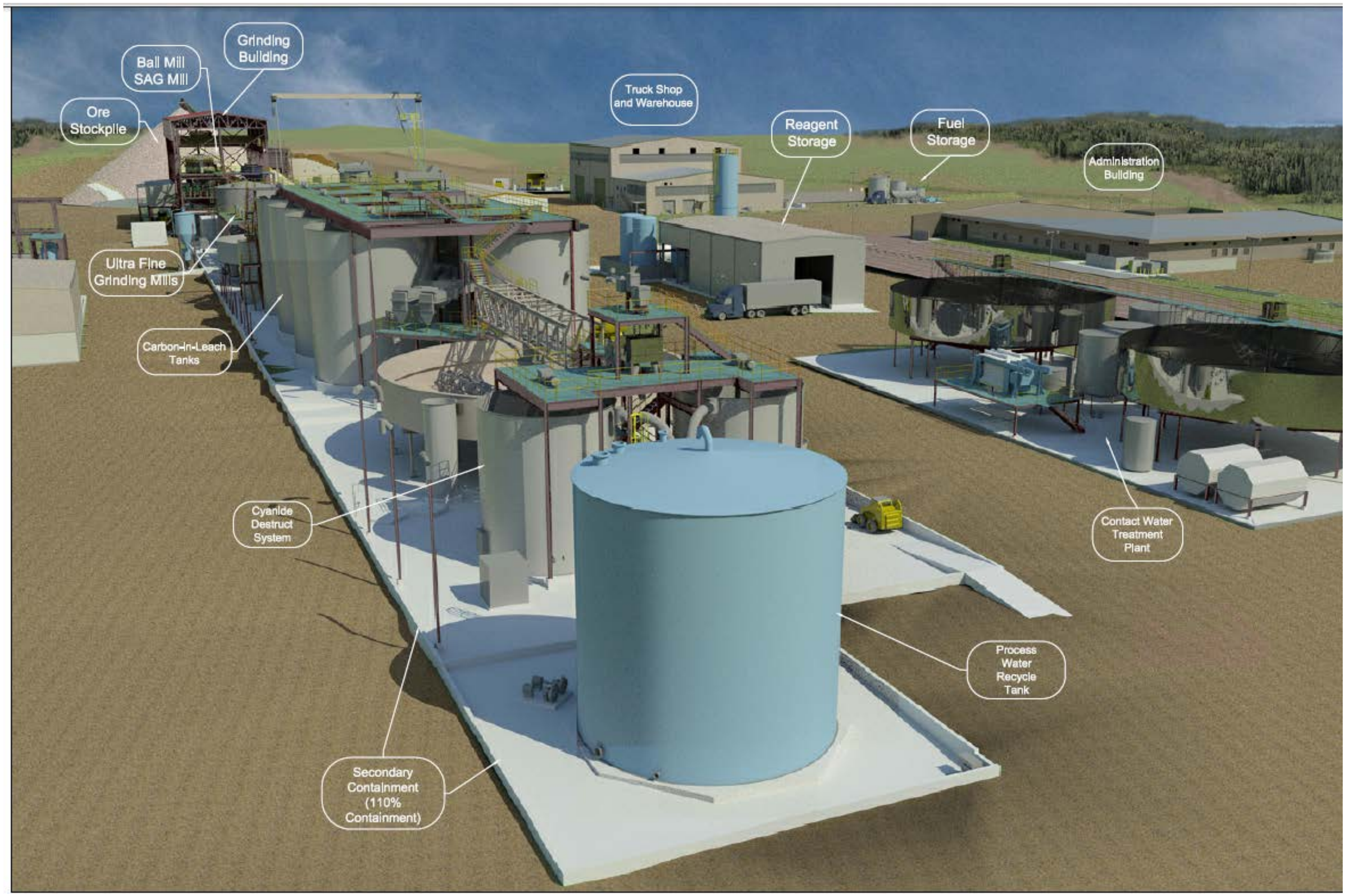


Figure A-22 Mill Site

Notes: Figure is based on engineering drawings. Viewed from the north.

Source: Haile 2013a.

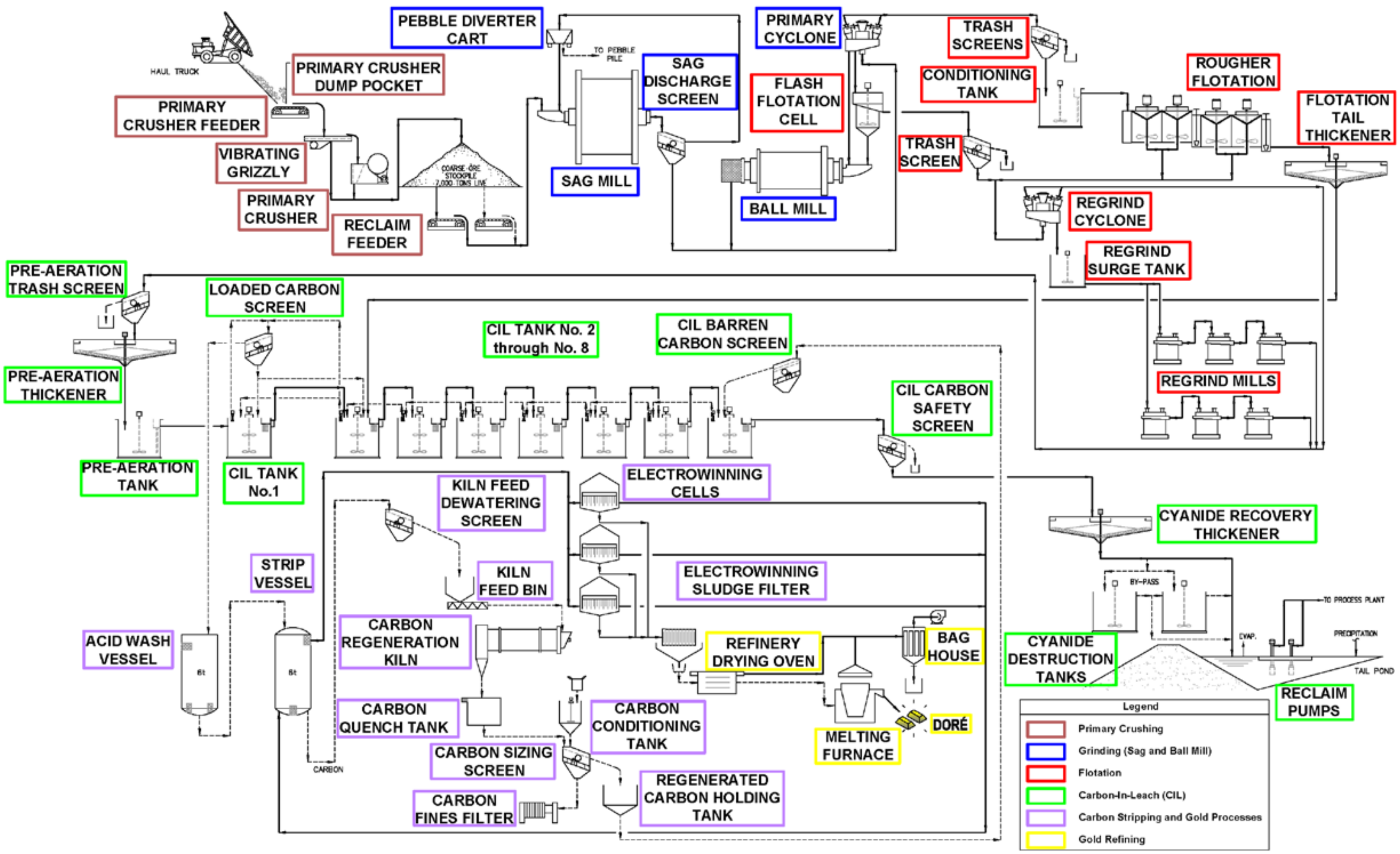


Figure A-23 General Mill Process Flow Sheet

Source: M3 Engineering & Technology 2012b (figure revised in 2013).

- Regrind (red) – The slurry concentrate of gold-bearing minerals from flotation would be ground further to approximately 13 microns in size, about the grain size of talcum powder, in the six regrind mills.
- Carbon in Leach (green) – The CIL process would take place in eight tanks. The reground concentrate slurry would be oxidized with air in the pre-aeration tank prior to being treated with sodium cyanide in CIL Tank No. 1. Dissolved gold would be adsorbed onto activated carbon. The discharge from CIL Tank No. 1 would flow by gravity to CIL Tank No. 2, where it would combine with the flotation tailing. The combined streams would be treated with sodium cyanide, and the dissolved gold would be adsorbed onto activated carbon in CIL Tanks Nos. 2 through 8. The discharge from CIL Tank No. 8 would be thickened, and most of the sodium cyanide would be returned to the concentrate treatment stage. Under normal operating conditions, the remaining flow would be pumped to the TSF. If the cyanide level is greater than or equal to 50 ppm WAD cyanide, the flow would be directed to the cyanide destruction tanks, where cyanide would be destroyed using a sulfur dioxide and air process.
- Carbon Stripping and Gold Processing (purple) – The gold-bearing activated carbon would be treated with chemicals to strip the gold from the carbon into solution (called "pregnant solution"). The gold would be removed from the pregnant solution in the electro-winning cells. In the cells, a gold-bearing "sludge" forms on the electro-winning cathodes. The sludge would be washed off of the cathodes and dried in an oven.
- After the gold is removed from the carbon, the carbon would be thermally reactivated by heating in a kiln to remove impurities. After reactivation, the carbon would be returned to the CIL circuit for reuse.
- Gold Refining and Processing (yellow) – The gold-bearing sludge is smelted to separate the gold from the waste material, poured into a mold, and cooled to form a doré bar that is a mixture of gold and silver.

More detail on the gold processing can be found in the Supplemental Analysis to the Mill Process Description and Process Flow Sheet (M3 Engineering & Technology 2012a).

Fumes from the carbon processing facility, drying oven, and the melting furnace would be collected through ductwork and cleaned before discharging through an exhaust control system to the atmosphere pursuant to an air permit issued by the SCDHEC, Bureau of Air Quality.

A.7.1 Sodium Cyanide Use and Recovery

Sodium cyanide would be used only in tanks and in the following manner within the closed-loop system for the Mill process water. Sodium cyanide would be added with activated carbon in the concentrate and flotation tailing treatment stages. (Prior to those stages, the slurry is aerated to oxidize the ore, which reduces the amount of sodium cyanide required to extract the gold.) In addition to sodium cyanide and activated carbon, lead nitrate and lime would be added in the concentrate and flotation tailing treatment stages in various amounts to enhance gold recovery and maintain the pH to ensure protective alkalinity. The CIL process would then take place in eight tanks. Slurry would advance from tank to tank by gravity, and the discharge from the last tank would report to the carbon screen. Because the particles of activated carbon with the adsorbed gold are larger than the slurry mixture, they would be retained in the tanks by screens while the waste slurry would pass through from tank to tank and finally out of the circuit.

Under normal operating conditions, the slurry would be pumped to the TSF. If the cyanide level is greater than or equal to 50 ppm WAD cyanide, the flow would be directed to the cyanide destruction tanks, where cyanide would be destroyed using a sulfur dioxide and air process.

In the cyanide destruction tanks, WAD cyanide is oxidized to form cyanate (OCN-). The process uses sulfur dioxide and air at a slightly alkaline pH in the presence of soluble copper to oxidize the cyanide. Through this process, the cyanate quickly decomposes in water to ammonium (NH_4) and bicarbonate (HCO_3) ions that are stable. This process was developed in the 1980s and is currently in use in over 30 mine sites worldwide. Ammonium bisulfite would be the source of sulfur dioxide, and air would be the source of oxygen. Copper sulfate would be added as a catalyst, as needed, and lime would be added to control pH.

Discharge from the cyanide destruction tanks would be pumped to the TSF with the tailing slurry. In the TSF, UV sunlight and air naturally decompose cyanide and cyanide complexes to further decrease cyanide levels.

A.7.2 Process Water Supply

Water for the Mill process would be obtained from the sources shown in Figure A-24. These sources include:

- Water reclaimed from the TSF tailing slurry;
- Groundwater pumped to dewater the areas adjacent to the mining pits (see Section A.9.1.2, “Depressurization Water Management” for details);
- Contact water pumped from the pit sumps and Johnny’s PAG via the 19 Pond; and
- Moisture retained within the ore.

In addition, Haile could use municipal water as makeup for the Mill. Haile would manage process water needs through internal reclaim and reuse (see M3 Engineering & Technology 2012a).

The Mill process water balance is dependent on water availability from the various water sources. Table A-8 provides a typical Mill process water balance with typical flows for dry and wet conditions.

As shown in Table A-8, in dry, average, and wet conditions, Haile expects that TSF reclaim water (reclaimed in the closed-loop process) would be the primary source of water for the Mill. The water level in the TSF would change in dry or wet periods. The use of fresh water (primarily groundwater from the depressurization wells) would increase only when the volume of TSF reclaim water decreases. Given dry conditions, the amount of water supplied from TSF reclaim is expected to range from 350 to 814 gallons per minute (gpm). The wide range of values is a product of the amount of free water that may be stored in the TSF prior to a drought. In the early years of operations, the TSF is expected to have adequate free water at all times; therefore, reclaim water from the TSF would remain at the maximum level of 814 gpm even in the event of a drought. If a drought occurs during the later years of operations, when free water levels in the TSF are lowest, reclaim water from the TSF could be as low as 350 gpm.

Variability in Mill use of fresh water in dry conditions results from the amount of TSF reclaim water available. Minimum fresh water inflows of 104 gpm would occur at times when reclaim from the TSF can be maintained at 814 gpm, despite dry conditions. Maximum fresh water inflows of 568 gpm would occur at times when available TSF reclaim is limited to 350 gpm. At levels between these extremes, the ratio of TSF reclaim water to fresh water could vary based on the available TSF reclaim water.

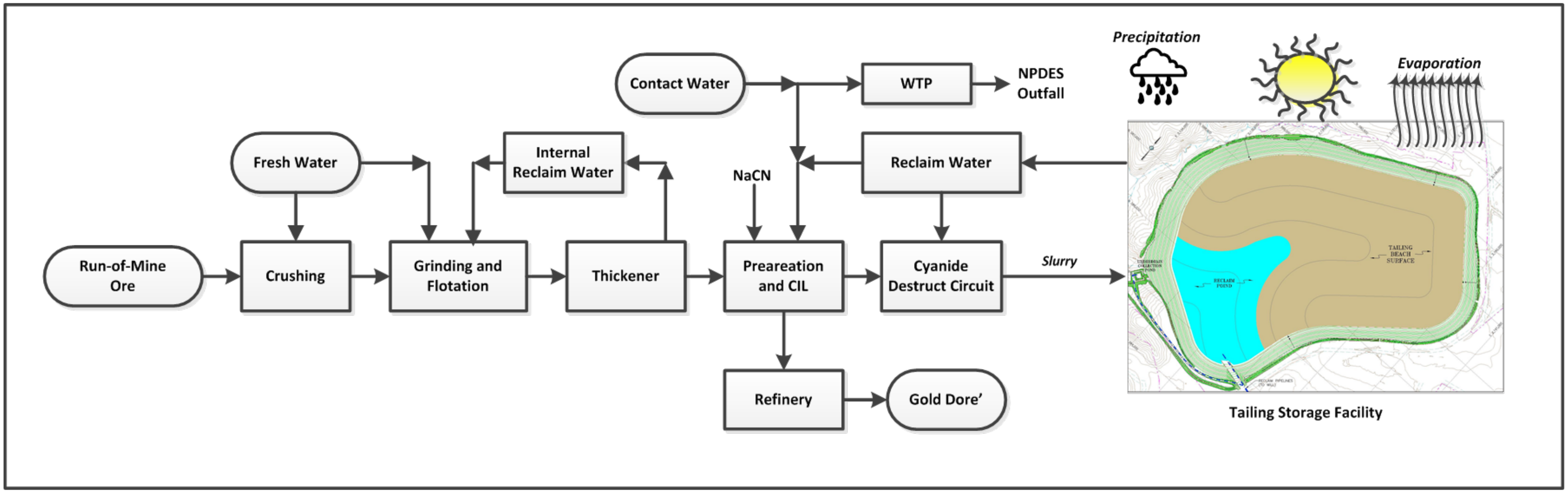


Figure A-24 Process Water Supply

Source: Haile 2013.

Table A-8 Typical Mill Process Water Balance

Water Source	Dry Conditions (gpm)	Average and Wet Conditions (gpm)
Input		
Fresh water	104–568	104
Water retained in ore	47	47
Contact water	0	0
TSF reclaim water	350–814	814
Total input needed for Mill	965	965
Output		
Mill Site discharge to TSF	(965)	(965)

Notes:

gpm = gallons per minute

This table presents typical ranges of water supplied to the Mill. Dry conditions represent operations in a severe drought when no precipitation occurs for an extended duration; the right-hand column represents water supplied to the Mill in average and wetter-than-average conditions.

While contact water is identified above as a Mill water source, it is not listed in Table A-8 for dry conditions or for average and wet conditions. Contact water is derived from runoff and seepage from PAG material and precipitation falling into the pits that have been mined into PAG materials. During an extreme dry condition with no precipitation, little to no contact water would be generated; therefore, it cannot be counted on to meet Mill demands. During average and wet conditions, sufficient water would be available in the TSF to meet the full reclaim demand of 814 gpm, and contact water would not be brought into the Mill in these situations. The condition where contact water would be brought into the Mill is when only minimal amounts of free water exist in the TSF and precipitation occurs, but in limited amounts. Given this atypical condition, the volume of water in the TSF would not be sufficient to meet the full 814 gpm reclaim. Contact water would then be brought into the Mill to supplement TSF reclaim so that the total amount of TSF reclaim and contact water used equals 814 gpm, as available.

A.7.3 TSF Reclaim Water

TSF reclaim water would be reused in the Mill process. The reclaim water would cycle between the Mill and the HDPE-lined TSF in a closed loop, which would prevent the Mill process water from being discharged into the environment. As described above, the concentration of WAD cyanide would be reduced below 50 ppm, in accordance with the International Cyanide Management Code.

Using average precipitation conditions, a maximum of approximately 1,010 acre-feet of reclaimed water would be stored in the TSF near the beginning of Mine Year 4 operations. Water volumes in the TSF pond would increase before Mine Year 4 and diminish as the mine plan progresses into later years. However, a process water pool would remain throughout the life of the facility. If a prolonged period of extreme precipitation were to occur (a 95th-percentile wet cycle), water storage in the TSF would be expected to approach approximately 1,590 acre-feet. In all cases, the TSF is designed to store rainfall associated with the probable maximum precipitation (PMP) event while maintaining an additional 4 feet of freeboard. The American Meteorological Society defines a *PMP event* as “the theoretically greatest depth of precipitation for a given duration that is physically possible over a particular drainage basin at a particular time of year" (AMS 1959). The PMP storm for the Haile Gold Mine site is calculated as 47.96 inches for a 72-hour event. Freeboard is a function of the facility design and is calculated in order to provide a factor of safety greater than that for which the facility is designed.

At the end of the production phase of the mine, Haile's NPDES permit would be modified to include a treatment system for this process water. This new process water treatment system would continue to treat underdrainage from the TSF until the flows have diminished to a level where the outflow can be treated in a passive treatment system (see Section A.11, "Site Reclamation" for further details).

A.7.4 Reagents

Reagents are chemicals or solutions used in gold ore processing to produce a desired reaction. Reagents that would require handling, mixing, and distribution systems are listed in Table A-9.

Table A-9. Reagents Used in Ore Processing

Reagent	Use	Maximum On-Site Storage Capacity[a]
Aero 404 (l)	AERO 404 (or an equivalent flotation promoter) would be added to the SAG mill and flotation stage to enhance flotation recovery of gold and gold-bearing sulfide minerals.	26 tons 6,070 gallons (total) One tank @ 6,070 gallons
Ammonium bisulfite (ABS) (l)	Ammonium bisulfite would be used in the sodium cyanide destruction circuit. Ammonium bisulfite would be added to the sodium cyanide destruction tanks as the primary source of sulfur dioxide (SO2), which would be used to oxidize free sodium cyanide and weak acid dissociable (WAD) metal sodium cyanide complexes (SO_2/air process).	30 tons 6,365 gallons (total) One tank @ 6,365 gallons
Antiscalant (l)	Antiscalant would be added to the barren strip solution, reclaim water, and internal reclaim water tanks to prevent scaling in pipelines and tanks.b	25 tons 7,950 gallons (total) Three tanks @ 2,650 gallons (each)
Caustic soda (sodium hydroxide) (NaOH) (l)	Caustic soda solution would be used to neutralize acidic solutions after acid washing in the carbon strip stage. Caustic soda can be added to the sodium cyanide mix tank for pH control, if needed.	31 tons 5,265 gallons (total) One tank @ 5,265 gallons
Copper sulfate ($CuSO_4$) (s)	Copper sulfate would be delivered dry and stored in bags until mixed with water in a distribution tank. Copper sulfate is added to the sodium cyanide destruction tanks to provide copper ions as a catalyst for the sodium cyanide destruction process.	6 tons dry on pallets plus One mix tank @ 6,390 gallons and one distribution tank @ 6,360 gallons
Flocculant (s)	Flocculant would be delivered dry and stored in bags until mixed with water in three separate distribution tanks. Flocculant would be added during the slurry thickening process to promote solids settling.	26 tons dry on pallets plus 13,800 gallons mixed – two tanks @ 5,750 gallons and one tank @ 2,300 gallons
Flux (s)	Flux would be added in the gold refining stage to remove contaminants from the precious metals. Flux would be added in solid form.	3 tons

Table A-9. Reagents Used in Ore Processing (Continued)

Reagent	Use	Maximum On-Site Storage Capacity[a]
Frother (MIBC) (l)	Frother would be added at the flotation stage to enable flotation of gold-bearing sulfide minerals.	25 tons 7,500 gallons (total) One tank @ 7,500 gallons
Hydrochloric acid (HCl) (l)	Hydrochloric acid would be used in the carbon strip stage to acid wash carbon.	25 tons 5,100 gallons (total) One tank @ 5,100 gallons
Lead nitrate (PbNO3) (s)	Lead nitrate would be delivered dry and stored in bags until mixed with water in a distribution tank. Lead nitrate would be added in the pre-aeration stage to enhance leaching.	6 tons dry on pallets One mix and distribution tank @ 1,550 gallons
Potassium amyl xanthate (PAX) (s)	PAX (flotation collector) would be delivered dry and stored in bags until mixed with water in a distribution tank. PAX would be added to the grinding and flotation stages to facilitate flotation of gold-bearing sulfide minerals.	30 tons on pallets plus One 5,140-gallon mixing tank and one distribution tank at 5,485 gallons
Quicklime (pebble lime) (CaO) (l) and (s)	Milk-of-lime slurry (MOL) would be produced by hydrating pebble quicklime. MOL would be used to control pH in various parts of the process. MOL would be distributed to the concentrate treatment stage (pre-aeration), CIL tank Nos. 1 and 2, thickeners, and the sodium cyanide destruction circuit.	One silo at 100 tons dry One mixing and distribution tank @ 24,000 gallons
Sodium cyanide (NaCN) (l)	Sodium cyanide solution would be added to the ore in the leach circuit to recover gold and silver. Sodium cyanide solution also would be used to promote removal of gold and silver from the carbon in the carbon strip stage.	46 tons 51,000 gallons (total) Two tanks @ 25,500 gallons (each)
Sulfuric acid (H2SO$_4$) (l)	Sulfuric acid may be used in the grinding and flotation stages to maintain appropriate pH levels needed for sulfide mineral flotation.	34 tons 5,480 gallons (total) One tank @ 5,480 gallons
UNR 811A (l)	UNR 811A (or an equivalent chelating agent) would be used to abate mercury production by complexing mercury to form a stable organic sulfide precipitate. UNR 811A would be added, as necessary, to the reclaim water tank and the internal reclaim water tank.	5.3 tons 1,125 gallons (total) Four tote bins @ 280 gallons (each)

Notes:

(l) = liquid

(s) = solid

[a] Actual volumes stored on site may be less than full storage capacities based on factors such as replenishment order points, market conditions, vendor logistics, Mill throughput, reagent availability, delivery options, and process optimization.

[b] Antiscalant is a vendor-supplied package.

Source: M3 Engineering & Technology 2012a (table data revised in 2013).

The dry reagents would be stored under cover and then mixed in reagent mixing tanks and transferred to distribution tanks for process use. Figure A-25 shows the processing facility and water treatment system, with the reagent facility in the foreground.

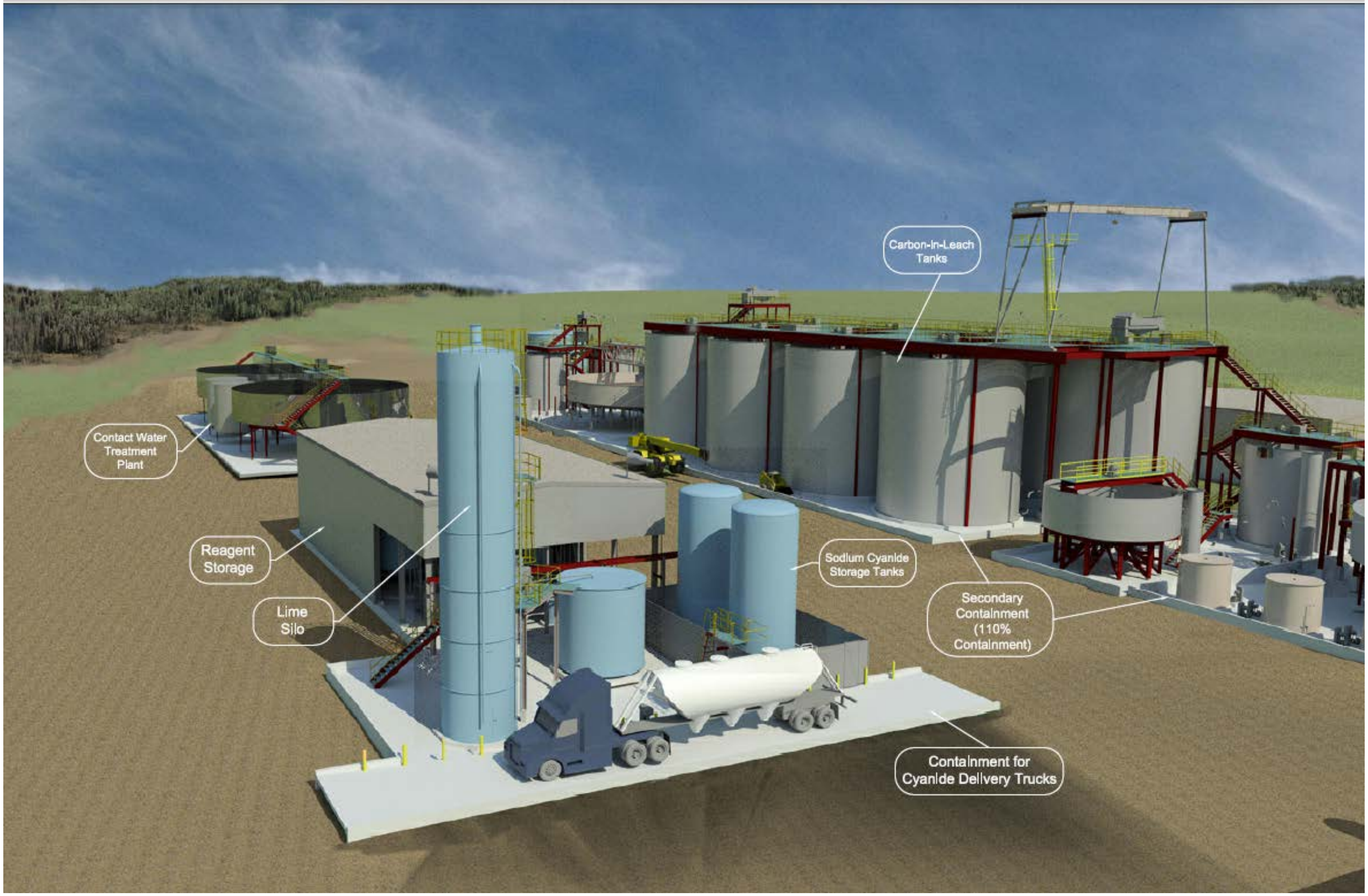


Figure A-25 The Mill (right side of image), Reagent Facility (center), and Contact Water Treatment Plant (behind the reagent facility)

Source: Haile 2013a.

The reagent building would be a steel-framed structure with metal roofing. In general, the building would be open, but metal siding would be installed where necessary to keep reagents dry. The floors would be slab on-grade concrete, with concrete containment walls to capture spills and any precipitation that enters the sides of the structure. Reagents that are not compatible to be stored together would be kept in separate containment areas within the reagent storage area.

A.7.5 Spill Containment

The ore processing facilities, chemical storage areas, and fuel storage areas are designed with the capacity to contain spills or leaks, with the volume to hold a 100 year, 24-hour storm event, assuming that it would occur in conjunction with a spill or leak. Each area would be built on a concrete floor with cast-in-place concrete walls. The floor area and wall heights are designed to capture any spills, and the floors slope toward a collection sump for cleanup and return of the spill to the process stream for which it is best suited. The floor area and walls are designed to capture 110 percent of the largest vessel (or container) in that process area plus stormwater (for the 100-year, 24-hour storm event) if it is open to the sky. If a spill is greater than the facility’s containment capacity, it would be captured and flow into the Process Event Pond (explained below). Table A-10 summarizes the proposed containment systems and volumes for components of the Mill and Mill Site.

In the event of a spill that exceeds a facility’s containment capacity, the overflow would drain to the adjacent Process Event Pond, which is designed to act as a failsafe in case individual containment systems have insufficient capacity. The Process Event Pond is designed to capture quantities of spilled solution or slurry that may exceed the main process containment facilities, tailing slurry pipeline contents, or reclaim water line contents. It would be constructed on the north end of the processing facilities, adjacent to the refinery (shown in Figure A-21). Each containment area is designed to capture spills in accordance with Table A-10.

The Process Event Pond would be an approximately 1.5-million-gallon-capacity HDPE-lined pond to handle overflow events for fluids that would require treatment before release to the environment. Should multiple spill events occur in the processing area, any material that would not fit within the containment area would flow to the Process Event Pond. The additional solution or slurry from the failure would exit the containment area through a pipeline and would flow by gravity to the HDPE-lined Process Event Pond. The tailing slurry and process water pipelines (described below) are designed to have double containment, involving either a pipeline within a pipeline or a pipeline within a lined containment structure or trench. Should a failure of the tailing or process water pipelines occur, or in the event of a prolonged unplanned power outage, the material from the pipelines would drain to the Process Event Pond.

Once the failures have been repaired, or power restored, the material in the Process Event Pond would be returned to the cyanide recovery thickener or applicable area for processing. Water from a spill or incident that contacts processing reagents would be suitable for use in the closed-loop system, which includes use of process water from the TSF.

In addition to the containment systems identified for the Mill and Mill Site in Table A-10, the following support facilities also would have spill control measures: the truck shop, fuel storage locations, hazardous waste storage building, and electrical substation. Chemical storage and containment are designed to avoid mixing chemicals that interact negatively.

Table A-10 Proposed Containment Systems for the Mill and Mill Site

Containment Area	Indoor / Outdoor?	Containment System	Containment Volume	Sump Pumps to
Primary crusher	Outdoor	Concrete pad with stem walls	100-year, 24-hour storm event	Stockpile Collection Pond
Grinding (SAG and Ball mill) building	Covered	Concrete pad with stem walls	110% of largest vessel	Grinding circuit
Flotation and regrind	Outdoor	Concrete pad with stem walls	110% of largest vessel + 100-year, 24-hour storm event (utilizing overflow to adjacent containment areas)	Flotation circuit
Pre-aeration thickener	Outdoor	Concrete pad with stem walls	110% of largest vessel + 100-year, 24-hour storm event (utilizing overflow to adjacent containment areas)	Pre-aeration thickener
Flotation tail thickener	Outdoor	Concrete pad with stem walls	110% of largest vessel + 100-year, 24-hour storm event (utilizing overflow to adjacent containment areas)	Flotation tail thickener
Carbon-in-leach (CIL) area	Outdoor	Concrete pad with stem walls	110% of largest vessel + 100-year, 24-hour storm event (utilizing overflow to adjacent containment areas)	CIL circuit
Cyanide recovery thickener/cyanide destruction	Outdoor	Concrete pad with stem walls	110% of largest vessel + 100-year, 24-hour storm event (utilizing overflow to adjacent containment areas)	Cyanide destruction
Reagent mixing area	Covered	Concrete pad with stem walls	110% of largest vessel in each containment area + 100-year, 24-hour storm event	Cyanide destruction
Reagent storage area	Outdoor	Concrete pad with stem walls	110% of largest vessel in each containment area + 100-year, 24-hour storm event	CIL circuit
Reclaim water pad	Outdoor	Concrete pad with stem walls	110% of largest vessel + 100-year, 24-hour storm event	Reclaim water tank
Tailing line	Outdoor	Lined trench and pond	110% of the entire pipeline volume + 100-year, 24-hour storm event	Process Event Pond
Truck shop tank farm	Outdoor	Double-walled tanks	Tanks are double-walled on concrete foundations	No sump in this area; any spills would be remediated at the point of spill

Table A-10 Proposed Containment Systems for the Mill and Mill Site (Continued)

Containment Area	Indoor / Outdoor?	Containment System	Containment Volume	Sump Pumps to
arbon acid wash	Outdoor	Concrete pad with stem walls	110% of largest vessel + 100-year, 24-hour storm event	Carbon acid wash
Carbon strip	Outdoor	Concrete pad with stem walls	110% of largest vessel + 100-year, 24-hour storm event	Carbon strip
Carbon regeneration	Outdoor	Concrete pad with stem walls	110% of largest vessel + 100 Year/ 24 hour storm event	Carbon regeneration
Refinery	Indoor	Concrete pad with stem walls	110% of largest vessel	Refinery
Fuel storage	Outdoor	Double-walled tanks	Tanks are double-walled on concrete foundations	No sump in this area; any spills would be remediated at the point of spill

Source: M3 Engineering & Technology 2012a.

A.7.6 Electrical Power

The Haile Gold Mine straddles the boundary between the Duke Energy-franchised electric service territory and that of Lynches River Rural Electric Cooperative (Lynches River). Depending on where the Mill is located on the property, power could be supplied by either company. Consequently, in 2009, both companies were contacted to determine what would be required for each utility to serve the mine and what power would be available from each, and to estimate the cost for each service. As the result of several meetings, an agreement was reached between Duke Energy, Lynches River, and Haile. Haile would enter into an agreement with Duke Energy to supply the power and Lynches River—along with their engineering and construction partner, Central Electric Power Cooperative (Central Electric)—would construct a new 69 kilovolt (kV) overhead power line and a 69 kV/24.9 kV substation to serve the mine. It is anticipated that Duke Energy would enter into operating agreements with Santee Cooper (the South Carolina power grid operator), Central Electric, and Lynches River. Haile would deed approximately 0.5 acre of land adjacent to the Mill Site to Lynches River for construction of the substation. Figure A-21 shows the location of the proposed Lynches River substation.

Central Electric has an existing 69 kV power line, known as the Heath Springs to Flat Bush transmission line, that runs in an east-west direction north of the proposed Haile Gold Mine site. A new connecting 69 kV line of approximately 4.5 miles would be constructed to run from near the intersection of this line and Duckwood Road north of US Highway 903 to a substation on the Haile Gold Mine property. Most of the new line at the Mill Site would run within or alongside of the existing Duckwood Road and US 601 utility right-of-way. The various roads near the new line are shown in red on Figure A-26. This 4.5-mile line and substation would be dedicated to Haile Gold Mine. Figure A-26 shows the location of the new 70-foot-wide right-of-way from the Haile substation to the tie-in location north of US Highway 903.

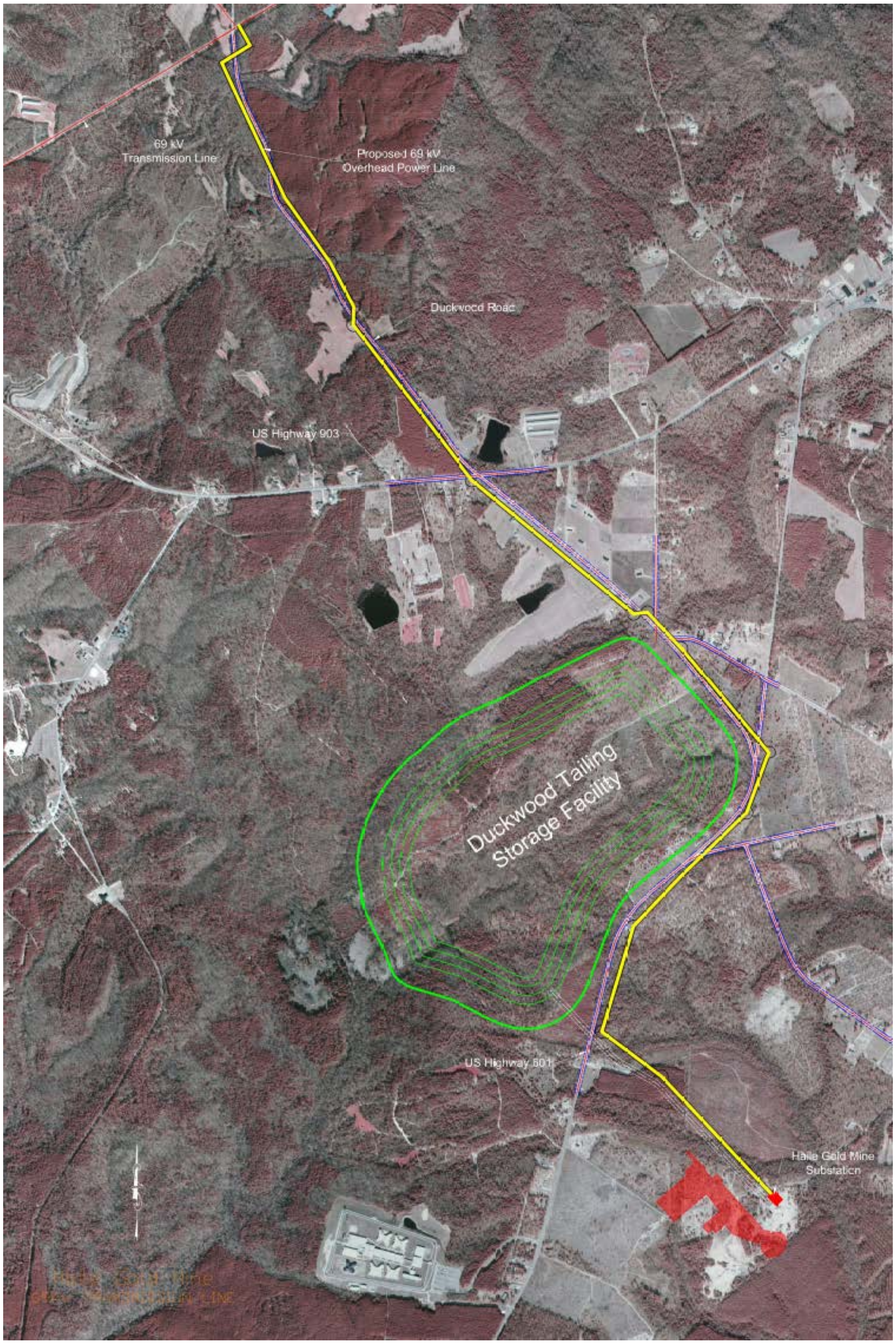


Figure A-26 Power Line Right-of-Way

Source: Haile 2013a.

After the mine is permanently closed, the line and substation would be available to serve other customers. If other potential customers ask for service from the line and substation while the mine is operating, Haile would consider such requests, provided that there is no degradation to the quality of power delivered to Haile.

The peak electrical load for the Haile Gold Mine would be approximately 14 megawatts (MW), and the typical operating load would be from 11 to 12 MW. Power would be distributed throughout the site via underground duct banks as well as by a series of 24.9 kV overhead lines. Figure A-21 shows the 24.9 kV overhead power lines around the Mill Site, as well as Central Electric's incoming 69 kV overhead power line.

A.7.7 Natural Gas

Natural gas would be brought to the Project via a buried pipeline connecting to the Lancaster County Natural Gas Authority near US 601 to supply process requirements such as heating the carbon stripping solution, reactivating carbon, and comfort heating requirements. Figure A-27 shows the location of the natural gas pipeline and tie-in for the Project.

A.7.8 Potable Water

The Haile Gold Mine currently obtains potable water from the Lancaster County Water and Sewer District. The Project would be connected to the Town of Kershaw municipal water system. Figure A-27 shows the location of the potable water line and tie-in for the Project.

A.7.9 Fire Protection Water

The Haile Gold Mine does not presently have fire protection water supplied to the site. The current plan is to use water from Ledbetter Reservoir, should fire trucks be called to the site. For the new facilities, the Town of Kershaw would supply fire protection water from an existing 250,000-gallon storage tank near the Kershaw Correctional Institution via a pipeline installed by Haile. Figure A-27 shows the location of the fire protection water line and tie-in for the Project.

A.7.10 Sewage

The Haile Gold Mine currently uses a septic system, tank, and leach field to dispose of its sewage. The new facility would be connected to the Town of Kershaw municipal waste water treatment facility. Figure A-27 shows the location of the sewage line and tie-in for the Project.

A.8 Duckwood Tailings Storage Facility

Once the ore is processed to remove the gold, the resulting slurry of pulverized rock and process water, known as *tailings* (approximately 55 percent solids and 45 percent liquids by weight), would be piped to the TSF located across US 601 at the north end of the Project area. The TSF is designed for permanent storage of all tailings produced during operations of the Mill.

Figure A-27 Location of Sewer, Fire Protection Water, and Potable Water Lines and Tie-Ins for the Project

Source: Haile 2013a.

A.8.1 General Layout

The TSF would cover an area of approximately 524 acres (including the TSF, the TSF Underdrain Collection Pond that holds the seepage captured beneath the tailings but above the liner, the perimeter service road, diversion channels, and sediment control basins) located in the upper portion of Camp Branch Creek. The TSF would be constructed in four stages with storage to contain the current life-of-mine total tons of tailings. All four stages would allow for storage of an operating reclaim water pond and the PMP event, with 4 feet of freeboard above the maximum water elevation. The much smaller volume TSF Underdrain Collection Pond would have a freeboard of 2 feet. Benches along the interior embankment would be constructed for placement of the tailings distribution pipelines. Figure A-28 illustrates the ultimate configuration of the TSF.

The TSF is a four-sided embankment measuring approximately 5,500 feet by 3,500 feet along the embankment crest centerline for the longest embankment legs. It is constrained by the Project area boundary on the northeast and northwest, Duckwood Road on the east, US 601 on the southeast, and the existing surface drainages on the south and west. Existing topography in the area slopes toward the southwest at an average gradient of approximately 1 percent, with an overall maximum elevation change across the site of approximately 100 feet.

A.8.2 Stages of Construction

As noted, the TSF would be constructed in four stages. The first stage would consist of a starter embankment, allowing for 7.65 million tons of tailings storage, or approximately 3 years of deposition at a production rate of 2.5 million tons per year. A tailings density of 80 pounds per cubic foot was used to estimate the storage capacities for the facility.

The TSF embankment would be constructed to higher elevations during Years 2, 4, and 7 of production by increasing the height and width of the embankment. Figure A-29 illustrates a section of the TSF embankment at each stage of construction. Table A-11 provides details on the size of the TSF. The final embankment configuration would allow for a total storage capacity of approximately 40 million tons to account for variables in the production tailings densities.

The TSF Stage I embankment would require approximately 1.8 million cy of material to construct. The majority of this material would come from excavation of the tailings basin. Low-permeability soil and minor amounts of sand required for the composite liner and zoned embankment that are not available within the tailings basin would be augmented from the pre-production mining operations. After the tailings basin has been excavated, the soil liner will require approximately 1.2 million cy of sand and low-permeability soil.

The construction materials for Stage II (approximately 1.3 million cy) in Mine Year 2 and for Stage III (approximately 2.7 million cy) in Mine Year 4 of the TSF would come from two borrow sources identified west of the TSF—the Holly TSF borrow area (approximately 1.2 million cy) and the Hock TSF borrow area (approximately 2.9 million cy). See Figure A-30 for an aerial view of the Holly and Hock TSF borrow areas.

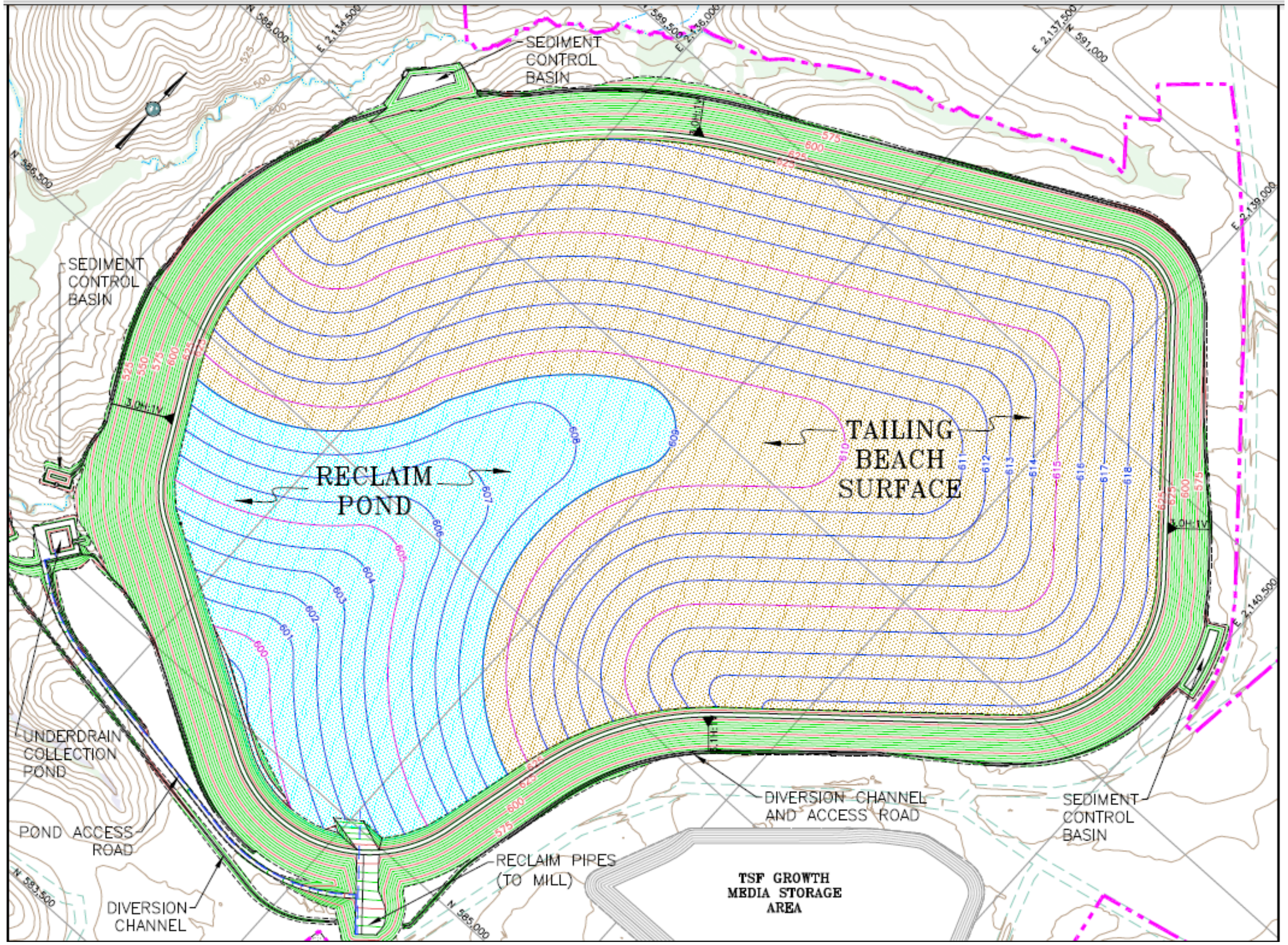


Figure A-28 Layout of the Tailings Storage Facility

Source: Haile 2012b (figure revised in 2013).

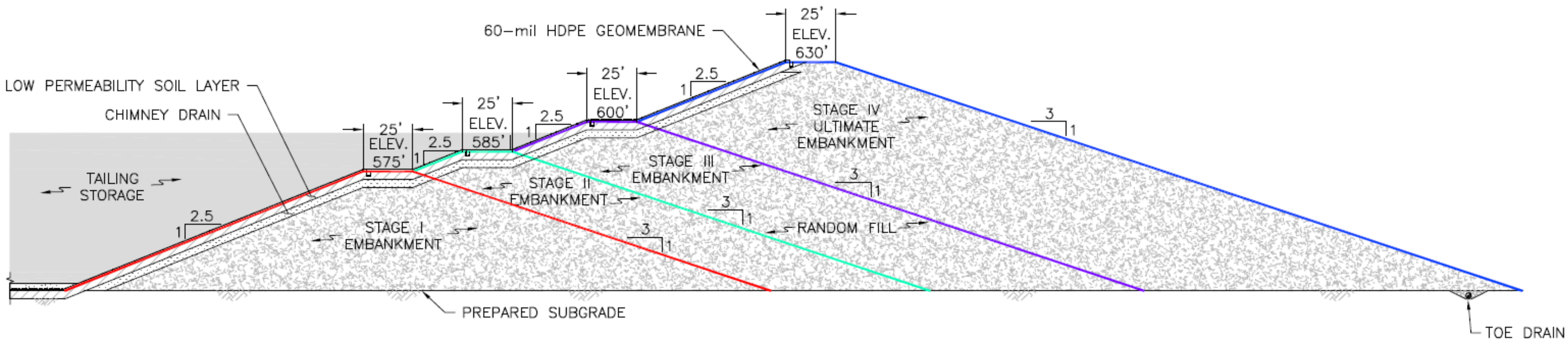
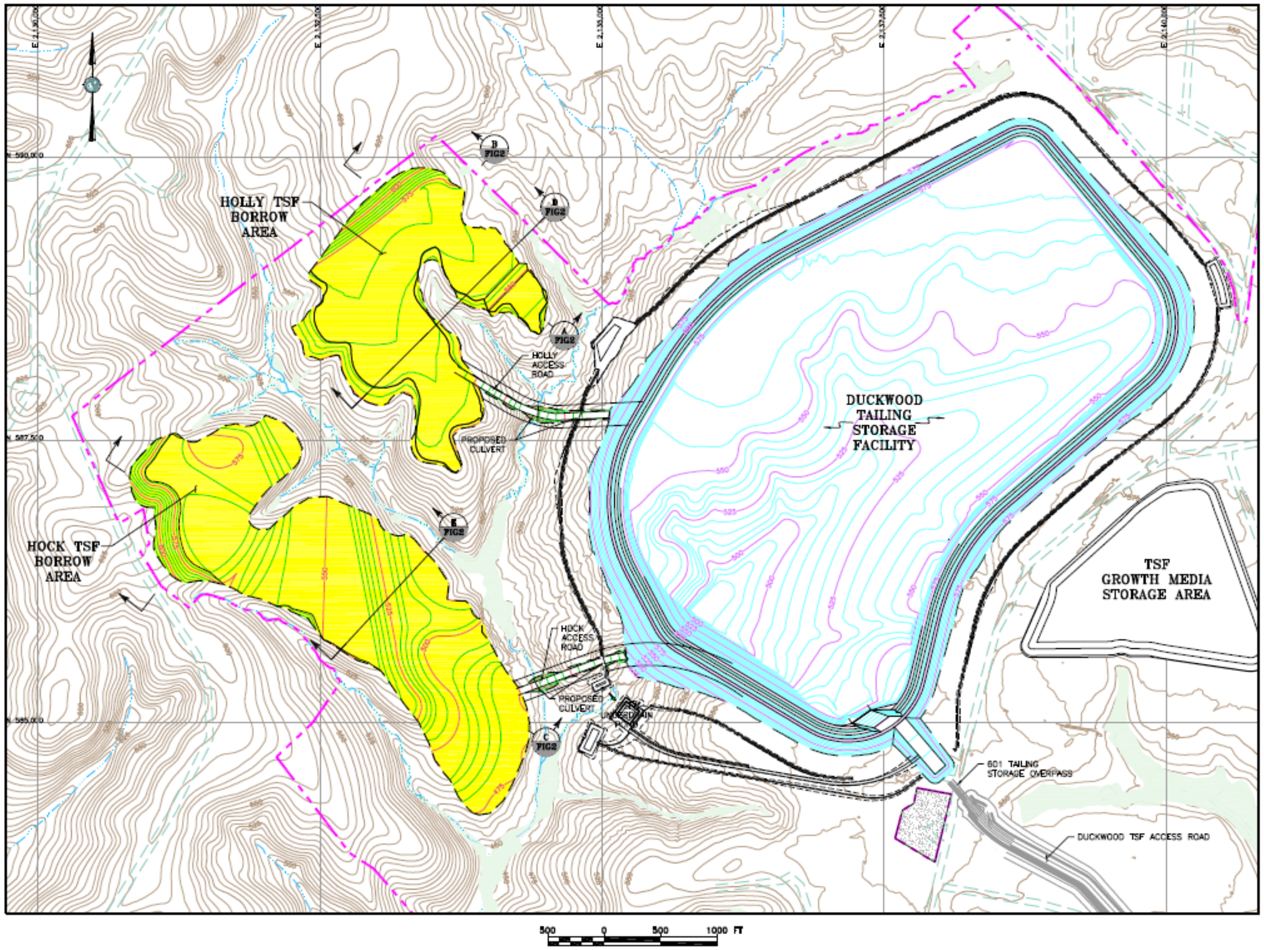


Figure A-29 Cross Section of the Tailings Storage Facility Embankment Showing the Stages of Construction

Source: Haile 2012b (figure revised in 2013).



LEGEND:

- EXISTING GROUND SURFACE CONTOUR EL. FEET
- PROPOSED BORROW AREAS FINISHED GRADE CONTOUR EL. FEET
- PROPOSED TSF FINISHED GRADE CONTOUR EL. FEET
- EXISTING ROADS
- PROPOSED ROADS
- EXISTING DRAINAGES
- PROJECT BOUNDARY
- WETLAND AREA
- LIMITS OF TSF BORROW
- PROPERTIES NOT CONTROLLED BY HAILE

NOTE

1. FINISHED GRADE OF THE BORROW AREA REMAINS ABOVE THE ASSUMED WATER TABLE.
2. FINISHED GRADE OF THE BORROW AREA WILL BE GRADED TO DRAIN, PREVENTING WATER FROM PONDING.

BORROW AREA VOLUME

FACILITY	AREA (SF)	ESTIMATED BORROW MATERIAL QUANTITY (yd^3)	ESTIMATED TOPSOIL VOLUME (yd^3)
HOLLY	2,897,917	1,211,900	107,330
HOCK	4,595,080	2,853,880	170,190
	TOTAL:	4,065,780	277,520

Figure A-30 Aerial View of Holly and Hock TSF Borrow Areas

Source: Haile 2013a.

Table A-11 Stages and Acreages of the Tailings Storage Facility

Phase	Year	Lined Area (acres)	Maximum Tailings Surface Area (acres)	Basin and Embankment Footprint (acres)
Stage I	Pre-Production	320	0	353
Stage II	2	326	219	377
Stage III	4	337	303	417
Stage IV	7	356	338	498
Ultimate Stage IV[a, b]	16	356	350	498

[a] The "Ultimate Stage IV" acreage provided in Table A-11 is less than the "Tailings Storage Facility and associated haul road and slurry pipeline" acreage provided in Table A-1, as Table A-11 does not include the TSF ancillary facilities.

[b] The ultimate stage is the final configuration of the tailings storage facility at closure.

Source: Haile 2012b.

It is anticipated that the Holly TSF borrow area would be depleted during Stage II of the TSF construction and the Hock TSF borrow area would be depleted during Stage III. See Figure A-31 for a cross section of the Holly and Hock TSF borrow areas before and after the borrow.

Any required quantities of low-permeability soils and clean sand to complete the embankment zones that are not available in the Holly and Hock TSF borrow areas would be obtained from the 601 OSA and hauled to the embankment.

The construction material for Stage IV of the TSF would be obtained from the 601 OSA and Ramona OSA. Approximately 7.3 million cy of material would be needed to construct the Stage IV embankment during Mine Year 7.

A.8.3 Design Components

The Duckwood TSF includes the following primary design components:

- **Zero Discharge –** the TSF is designed as a zero discharge facility. In addition to the anticipated tailings storage requirements, the facility is designed to contain the PMP storm event and an additional 4 feet of freeboard at all times.
  - Water drained from the tailings slurry at the TSF is the primary source of water used for the Mill, in a closed-loop process. If TSF water volumes are high (e.g., after a storm event), all stormwater would be used at the Mill, reducing the need for using make-up water at the Mill. All water would be used in the closed-loop cycle and would not be released into the environment.

- **Zoned Earthfill Embankment –** The TSF is designed as a zoned, well-compacted earthfill material embankment. The TSF would be constructed in stages during the life of the mine. The zoned features of the TSF embankment consist of distinct parts or zones of dissimilar soil or rock materials. As shown in the cross section in Figure A-29, the majority of the TSF would be built using a shell zone of random fill material on the exterior, downstream side of the embankment using Coastal Plains Sand (CPS), saprolite or bedrock. Interior, upstream to the random fill is the chimney drain zone. The chimney drain would be constructed of CPS and is designed to control any unlikely seepage from the tailings basin reclaim pond and preserve the integrity of the downstream random fill zone. Upstream of the chimney drain is the compacted low-permeability soil layer zone.

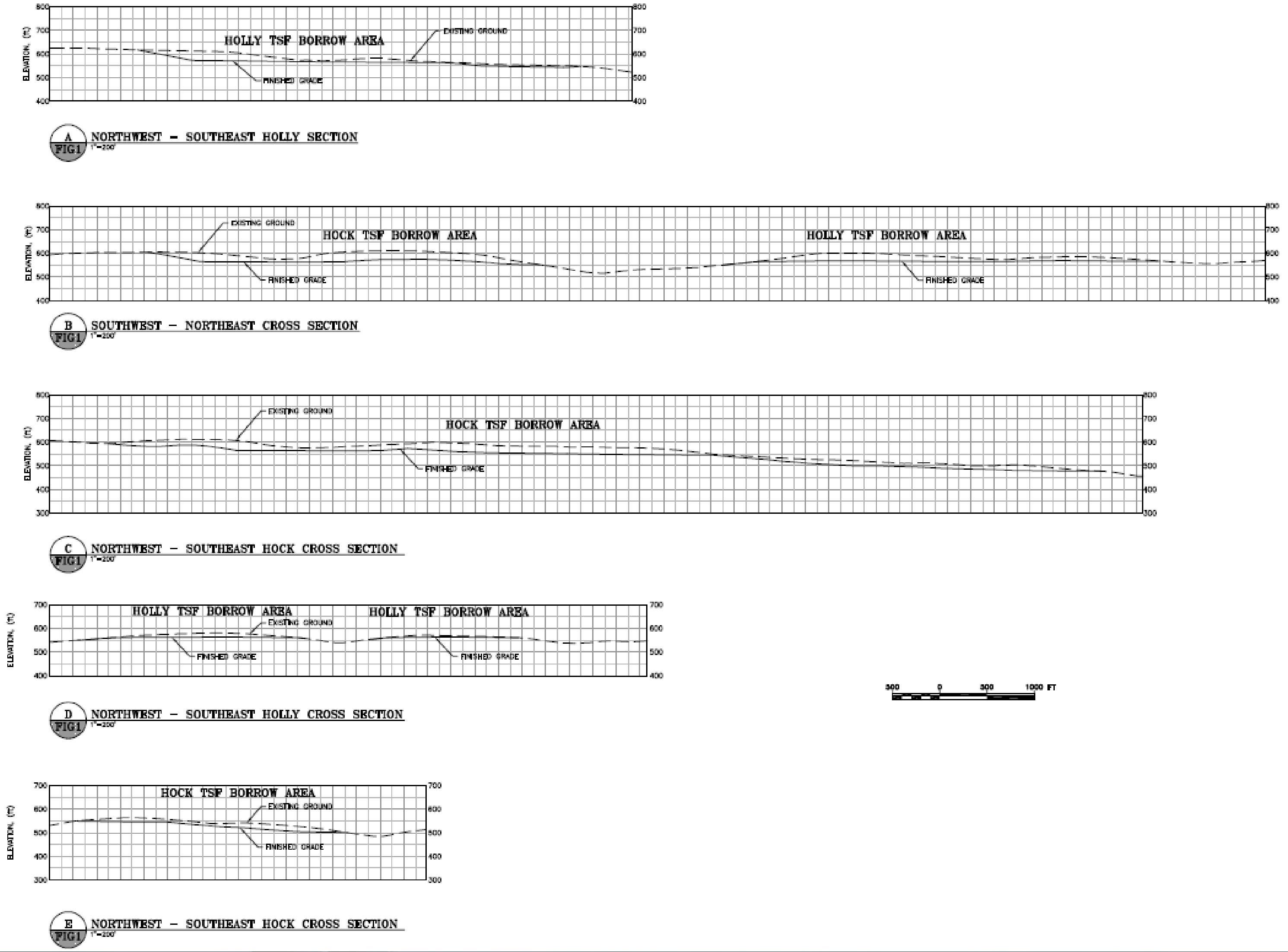


Figure A-31 Cross Section of Holly and Hock TSF Borrow Areas before and after Borrow

Source: Haile 2013a.

This low-permeability soil layer would be constructed of saprolite from the mine overburden. The purpose of the low-permeability soil layer is three-fold:

1. To preserve the integrity of the composite liner system within the TSF basin and interior embankment;
2. To act as a suitable layer for placement of the 60-mil HDPE geomembrane liner; and
3. To act as a secondary liner to control any seepage through defects in the HDPE geomembrane liner and prevent the tailings from migration into the chimney drain.

Both the chimney drain and low-permeability soil layer zones would consist of selected, fine-grained materials designed to meet the geotechnical specifications for particle size and other engineering parameters, such as the gradation of particle size and plasticity to ensure against segregation and clogging, and basic filter and permeability criteria for each of the two zone materials.

- **Toe Drain –** As part of the ultimate TSF embankment construction, a toe drain would be constructed along the perimeter of the toe of the TSF footprint. The toe drain is shown in Figure A-29. The toe drain construction would consist of a ditch-type flow conduit of perforated pipe wrapped in a non-woven geotextile, backfilled with drainage aggregate, and covered with fill. The construction of the toe drain is similar to the groundwater drain shown in Figure A-32. The purpose of the toe drain is to ensure that (1) any seepage from precipitation within the exterior embankment slope is controlled; and (2) erosion of the embankment toe is reduced and routed safely into the sediment control channels and basins at locations around the TSF perimeter.
- **Basin –** The TSF basin would be fully lined with a 60-mil HDPE geomembrane underlain by 12 inches of a compacted low-permeability soil liner. Above the geomembrane liner, a network of perforated pipe and 18 inches of a drainage layer material would be built to collect and route underdrainage from the tailings to a central collection point. The basin would be graded to promote gravity flow to the downstream TSF Underdrain Collection Pond.
- **TSF Underdrain Collection Pond –** An HDPE geomembrane double-lined pond with a leak collection and recovery system (LCRS) would be constructed downstream of the embankment toe, at the southwest corner of the facility, for collection of underdrainage flows from the basin through a concrete-encased series of outlet pipes. See Figure A-32 for a cross-section view of the TSF underdrain collection system, which feeds the TSF Underdrain Collection Pond, located immediately adjacent to the TSF Reclaim Pond.. The TSF Underdrain Collection Pond is pumped back into the TSF Reclaim Pond for return to the Mill for reuse as process water.
- **Leakage Collection and Recovery Systems –** A LCRS would be constructed as part of the TSF Underdrain Collection Pond and all of the double-lined contact water collection ponds (for the 465, 469 and 19 Collection Ponds). The purpose of the LCRS is to provide a method to collect seepage in the unlikely event that leakage should develop within the ponds through the primary HDPE liner. Seepage would be collected and removed from a low point located above the secondary HDPE liner. The LCRS design is shown in Figures A-32 and A-33.
- **Pipeline Corridor and Tailing Distribution System –** Benches along the interior embankment would be constructed for placement of the tailings slurry distribution pipeline. Rotational distribution of tailings slurry would be from the perimeter of the upper northwest, west, and upper northeast reaches of the facility through a series of drop bars. The reclaim and tailings slurry delivery pipe is included in the haul road corridor.

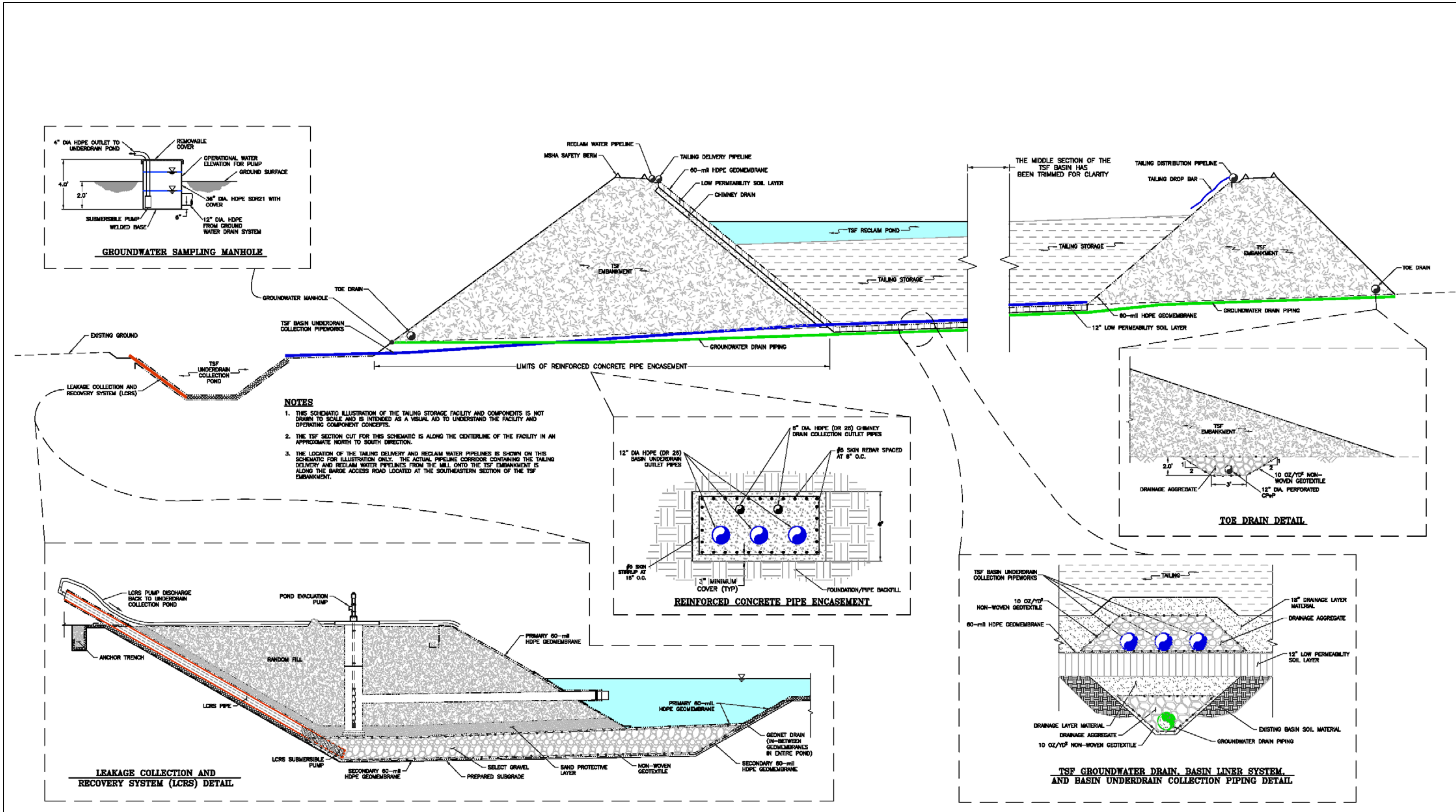


Figure A-32 Cross Section of TSF Groundwater Drain and Seepage Collection System

Source: Haile 2013a.

This page is left blank intentionally.

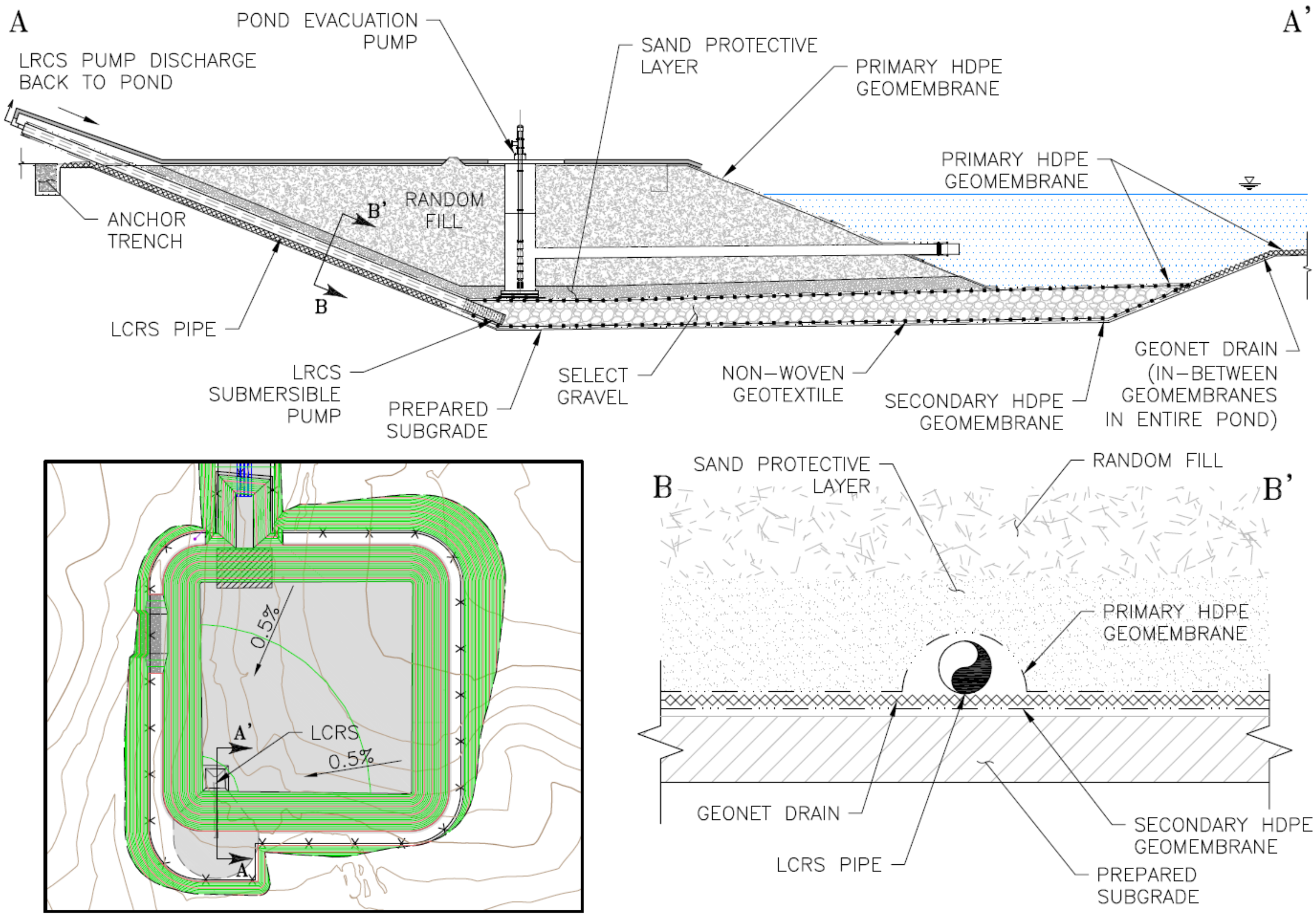


Figure A-33 Typical Leak Collection and Recovery System Design

Source: Haile 2013.

Tailings from the Mill would be pumped in a double-contained pipeline system (with one pipe placed inside another containment pipe) that minimizes the potential of an accidental spill to the distribution system along the interior crest perimeter of the TSF embankment. The tailings distribution system would be operated as a rotational tailings distribution system to control the reclaim water pond position and to promote tailings beach development within the TSF.

Banks of tailings drop bars (distribution pipes or spigots) would be operated rotationally using mainline valves to control a specific group of drop bars (8 to 10) spaced around the TSF perimeter. The individual drop bars are connected to the main distribution pipeline as valved off-takes with holes drilled in the top of each drop bar. When a bank of drop bars are actuated to direct flow to a specific location within the TSF, flow exits the drop bars—reducing flow energy and creating laminar flow along the perimeter of the TSF. Deposition in this manner results in a “beach” development by deposition of the coarser fraction of the tailings sand adjacent to the TSF embankment. The finer fraction of tailings moves away from the embankment along with the process water slurry.

The tailings beach development serves as a topographic feature within the TSF that would confine the TSF Reclaim Pond within the TSF to the southern end of facility. Process water from the TSF Reclaim Pond would be reclaimed and pumped back to the Mill for reuse in the mill process. (See Figure A-34 for an example of a tailings pond and facility.) Process water that drains through the tailings would be collected by the TSF underdrain collection system, which feeds the TSF Underdrain Collection Pond, and would be pumped back into the TSF Reclaim Pond and eventually back to the Mill for reuse as process water. The reclaim pipeline is also a double-contained system.

Figure A-34 TSF Reclaim Pond and Pumping Facility

Source: Newmont Mining Corporation 2012.

The process water reclaim system within the TSF would reclaim up to 814 gallons per minute (gpm) for reuse at the Mill. As a closed-loop system, process water would circulate only between the TSF and the Mill (zero discharge) and would be separate from other water management systems (see Section A.9, "Surface Water Management" for details).

The TSF would be open to the air and, except for water that evaporates, any precipitation that falls on the facility would become part of the closed-loop process water system. The TSF Underdrain Collection Pond is sized to contain the calculated underdrain flow for a 24-hour period in the event of a pump or power outage, plus precipitation from a 100-year, 24-hour storm event falling directly on the pond surface, and an additional 2 feet of freeboard. Given the size of the TSF Underdrain Collection Pond, 2 feet of freeboard provides an additional factor of safety. The TSF Underdrain Collection Pond is further protected against overflow because the valve can be closed or it can be pumped directly into the TSF Reclaim Pond, which can contain the PMP event in addition to 4 feet of freeboard at minimum (it can contain 4 feet of freeboard even as the TSF approaches the time to build a new stage, and more than 4 feet of freeboard after a new stage is constructed).

An Emergency Action Plan (EAP) has been developed to reduce the potential for loss of life and injury and to minimize property damage during an unusual or emergency event at the TSF. Locations and contact information for any residents or structures that may be flooded if the TSF should breach are noted. Names and numbers for federal, state, and local emergency contacts are provided in the notification list. The EAP provides an overview for roles and responsibilities, including methods to detect and evaluate the emergency condition, methods to assess the situation and determine the emergency level for notification, and procedures for communication and expected actions.

An Operations, Maintenance, and Inspection Manual has been prepared for the TSF. This manual is intended to serve as an operating guide for initial, normal, and emergency operating procedures for the TSF. The main components of the manual cover the following topics:

- Fluid management for the process water reclaim and TSF Underdrain Collection Pond;
- Facility instrumentation and monitoring for geotechnical and groundwater concerns;
- Operation of the tailings management system;
- Emergency operating procedures (power outage, extreme rainfall, excessive pond volumes);
- Component failure (leakage through liners, blockage of pipeworks, pump and pipeline failures); and
- Inspection and maintenance (daily, weekly, quarterly, and annually).

A.9 Surface Water Management

Surface water would be managed in the Project area based on its classification into one of three designations: non-contact water, contact water, and process water. Non-contact water is groundwater captured via depressurization pumping and stormwater runoff that does not come in contact with mined PAG material. Contact water is water that has come in contact with PAG material in the mine pits, the low grade ore stockpile, the Mill stockpile, or Johnny's PAG. Process water is water used in the Mill, which circulates in a closed-loop system within the Mill and the TSF, and has come in contact with sodium cyanide. These three classifications of water are each described in the sections below.

Figure A-35 illustrates the management and use of non-contact (green), contact (purple), and process water (red). Figure A-36 provides an overview of the location of non-contact, contact, and process waters across the Project. For purposes of illustration, Mine Year 5 of mine operations is shown in the figure. The colors used on the map to designate process, contact, and non-contact waters correspond with the colors used for those types of waters shown on the prior flow diagram (Figure A-35).

A.9.1 Non-Contact Water

Non-contact water does not require treatment at the contact water treatment plant; it includes precipitation and runoff from the property and Project facilities that do not contain PAG materials. Non-contact water would be subject to the SCDHEC, Bureau of Water, Stormwater Permitting Section's stormwater management practices and the permit conditions in Haile's Industrial General Permit. Non-contact water would flow through sediment detention ponds prior to release into the surface water system.

Non-contact water also includes water pumped from the ground as part of the pit depressurizing process, which removes groundwater from around the pit for pit stabilization and safety (see Section A.9.1.2, "Depressurization Water Management" for details). A portion of this water would be used to meet non-contact water demands in the Mill, and a portion would be used to meet dust suppression and construction water demands, with the excess discharged to Haile Gold Mine Creek.

A.9.1.1 Stormwater Management

Management of non-contact stormwater involves routing runoff from undisturbed areas around mine facilities, collection of stormwater runoff from non-PAG mine facilities, sediment control, and release of non-contact waters to the stream system.

The first role of the non-contract stormwater system is to keep runoff from undisturbed areas from coming into contact with mine facilities and operations. Diversion facilities are designed to capture runoff from undisturbed areas before it reaches disturbed ground. For major drainages such as Haile Gold Mine Creek and the North Fork of Haile Gold Mine Creek, stormwater management includes collecting flows and routing them past active mining areas in diversion pipes and releasing them into Lower Haile Gold Mine Creek.

Runoff from undisturbed areas that would otherwise come into contact with mine-related facilities (including such areas as Johnny's PAG, the TSF, OSAs, and roads) would be captured in diversion channels and routed past the disturbed area without commingling runoff from undisturbed and disturbed areas. This water would be released into natural drainages.

Runoff originating from non-PAG mine facilities is also classified as non-contact stormwater but would be managed in a different manner than runoff from undisturbed areas. Given that ground disturbance would occur at all non-PAG facilities, it is possible that sediment loading in runoff from these areas could be elevated. Haile would implement measures to minimize the amount of erosion from all disturbed areas, which would reduce the sediment loading carried in runoff from non-PAG mine facilities. Temporary erosion control measures would be implemented to minimize erosion and soil loss associated with initial ground disturbance. Methods of managing sediment and erosion control during construction would follow guidelines presented in the *Stormwater Management Handbook* (SCDHEC 2005) and would comply with Haile's Industrial General Permit. For the Mill area, an NPDES General Permit for Stormwater Discharges from Construction Activities would be required by the SCDHEC, Bureau of Water, Stormwater Permitting Section. Following construction, this area would follow Haile's Industrial General Permit.

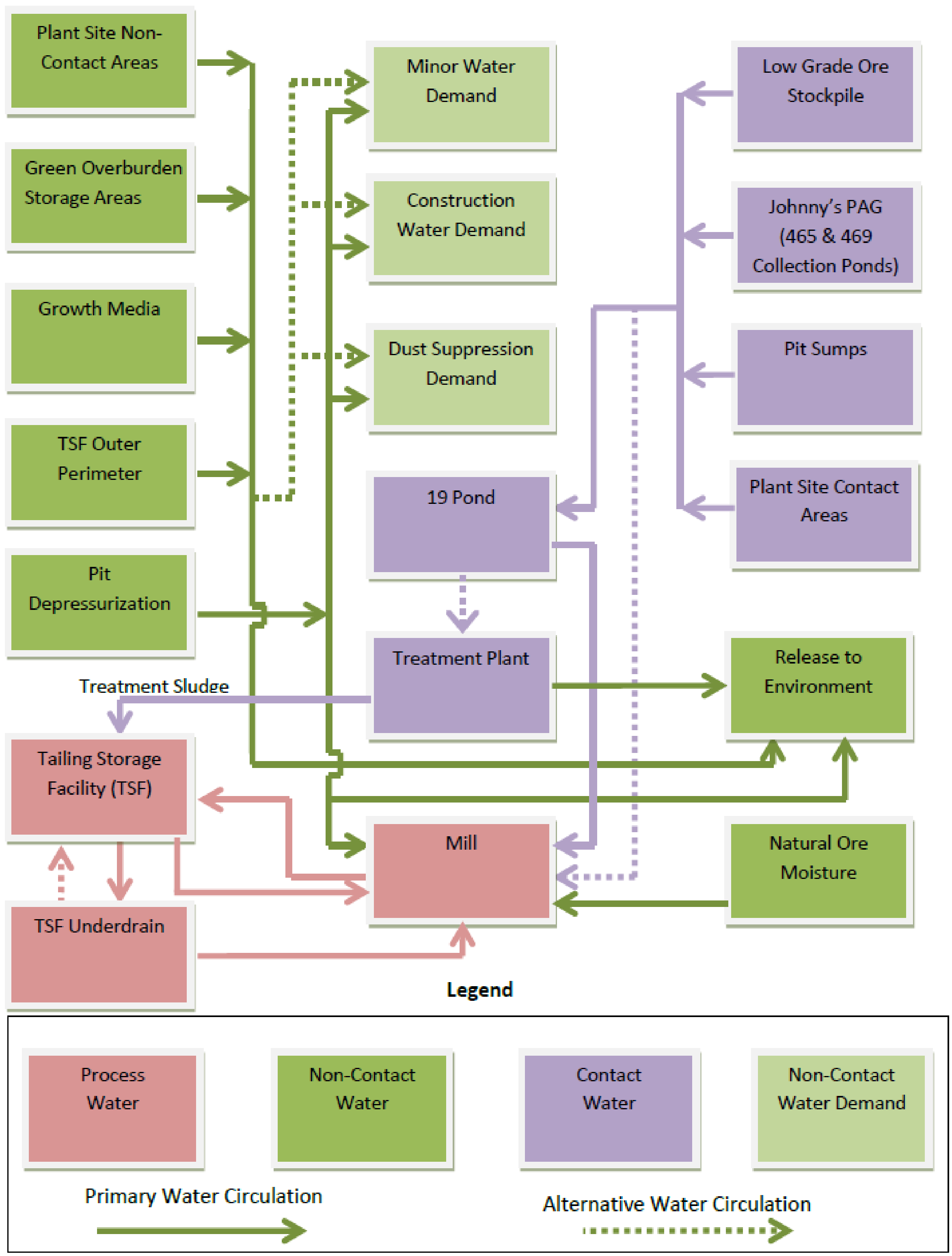


Figure A-35 Management of Non-Contact, Contact, and Process Water

Source: ERC 2012 (figure revised in 2013).

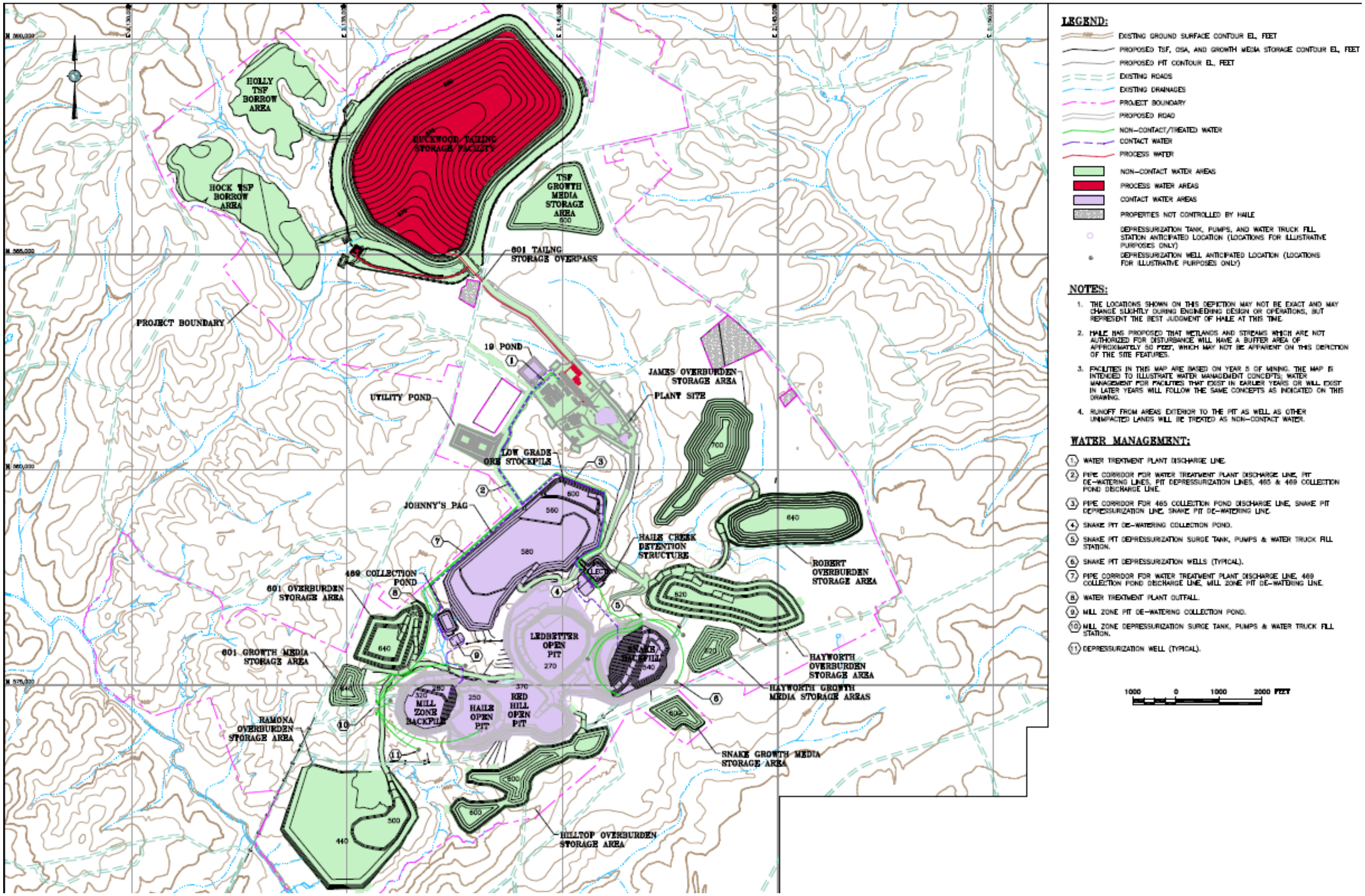


Figure A-36 Overview of the Location of Non-Contact, Contact, and Process Water

Source: Haile 2013a.

General runoff collection practices would include minimization of soil loss through direct stabilization of disturbed areas, including surface roughening, seeding, mulching, and erosion control blankets. Runoff collection measures would be implemented to limit erosion and movement of soils that are not contained in place. Concurrent reclamation practices would be implemented to minimize the duration of impacts and stabilize disturbed areas as quickly as possible.

Runoff and sediment that originates from non-PAG facilities would be captured in collection channels, including the outer perimeter of the TSF, the non-PAG OSAs, growth media storage areas, roads, and non-process areas of the Mill Site. Collection channels would route runoff from these areas to individual sediment collection basins. Each sediment basin is sized for particle removal efficiencies based on the SCDHEC, Bureau of Water standards and Haile's Industrial General Permit. Sediment ponds would effectively limit peak runoff rates and provide sediment removal, positively affecting both water quantity and quality from the non-PAG facilities. All sediment control systems, including collection channels and spillways, have the capacity to convey the 10-year, 24-hour storm event. Water from the individual sediment ponds would be released into natural drainages and would not be used by the mine, allowing these surface flows to continue to their natural drainages.

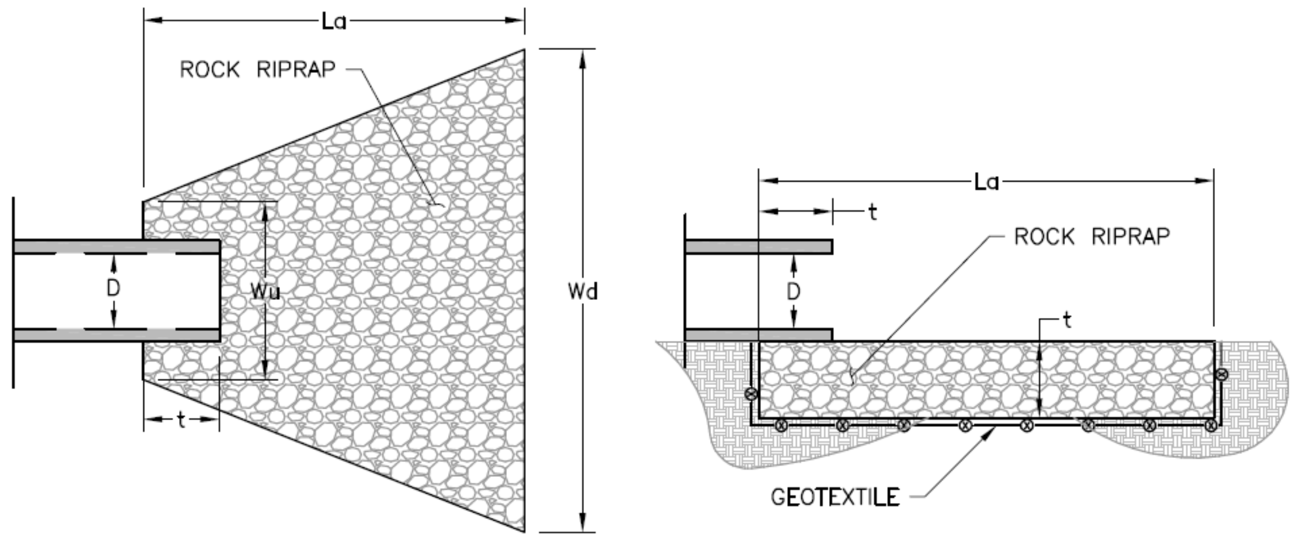
A.9.1.2 Depressurization Water Management

The number of depressurization wells may vary depending on the hydrogeology of each pit's area. Regardless of the number of wells, they all would discharge into depressurization water storage tanks, which would hold approximately 30,000 gallons each. These tanks would be located near the rim of their respective pit.

Depressurization water would be used at the Mill and for dust suppression. The 30,000-gallon tanks would have the capability to pump water to the Mill or into mine water truck(s). Any depressurization water not used on site would remain in the 30,000-gallon tanks until the tanks are full.

When the depressurization tanks are full, overflow would be discharged into Haile Gold Mine Creek via a pipe to an outfall, with an apron design similar to that shown in Figure A-37. This outfall structure would be located immediately downstream of the pit depressurization surge tanks (identified as Water Management Feature 5 in Figure A-36). In South Carolina, groundwater may be released to surface water without treatment so long as any contaminants in the water are not the result of an industrial activity (the contaminants are naturally occurring). Results of pumping well testing in the Project area between 2010 and 2012 indicate that water quality during long-term pumping would meet drinking water standards. Pumping well test results detected elevated levels of manganese and iron above the secondary drinking water standards; however, the levels were consistent with the results from other groundwater quality data collected upgradient of historical disturbance in the Project area, suggesting that elevated levels of these parameters are naturally present in the background groundwater.

In the unlikely event that the depressurization wells do not consistently produce as much water as anticipated, a Utility Pond would be constructed to store the depressurization water. The Utility Pond would consist of two cells of 25 million gallons each. The Utility Pond would entail a disturbance of approximately 15 acres located entirely in uplands. When the depressurization wells are producing more water than needed in the Mill and for dust suppression, depressurization water would be diverted from the depressurization water tanks to the Utility Pond for storage, as opposed to being discharged into Haile Gold Mine Creek. When the Mill or dust suppression needs require more water than the depressurization wells can provide, water would be withdrawn from the Utility Pond to meet these needs. Domestic water from the Town of Kershaw municipal water system also can be diverted into the Utility Pond for use in the Mill during dry conditions.



ROCK OUTLET PROTECTION APRON DIMENSIONS						
CULVERT SIZE D (IN)	ROCK SIZE d_{50} (IN)	APRON LENGTH La (FT)	UPSTREAM WIDTH Wu (FT)	DOWNSTREAM WIDTH Wd (FT)	THICKNESS t (IN)	QUANTITY (TONS)
12	6	12	3	13	12	15
18	9	16	4.50	18	24	20
21	9	18	5	20	24	35
24	9	20	6	22	24	60

Figure A-37 Typical Apron Design for the Depressurization Tanks and the Contact Water Treatment Plant NPDES Outfalls

Source: Haile 2013a.

A.9.1.3 Surface Water Diversion

Stream diversions would commence during Pre-Production. The diversion of the North Fork of Haile Gold Mine Creek (“North Fork diversion”) would be constructed to enable diversion of flow around the Mill Zone Pit, and the diversion structure would facilitate construction of the mine haul road that would cross between the Mill Zone Pit and Ramona OSA. Two parallel 24-inch pipelines would be installed through the haul road to collect water immediately upstream from the road. The 24-inch pipelines would be routed around mine workings and convey this diverted water past the Mill Zone Pit. From Pre-Production through Mine Year 1, the North Fork would be routed east of the Mill Zone Pit in a pipe diversion, from approximately 425 feet above mean sea level (amsl) down to natural stream grade at approximately 400 feet amsl.

The water level in Ledbetter Reservoir would be lowered starting in Pre-Production and finishing in Mine Year 3. Haile expects to use some of the water for Project purposes (e.g., construction and dust control) consistent with SCDHEC, Bureau of Water authorizations. Other flow from Ledbetter Reservoir into Lower Haile Gold Mine Creek would be diverted around the Mill Zone Pit area and would be managed with an appropriate diversion control structure.

See Figure A-38 for the location of the North Fork diversion and Ledbetter Reservoir diversion of Lower Haile Gold Mine Creek that would be established during Pre-Production.

Figure A-39 depicts the general design of the inlet for the North Fork diversion. This diversion would release into undisturbed portions of Haile Gold Mine Creek at approximately 400 feet amsl.

Figure A-40 shows a typical design of the outlet for the North Fork diversion pipe (how it would reconnect with Haile Gold Mine Creek). This outfall type is appropriate for use at the end of the piped diversions as flow rates, velocities, and water pressures would be high. The diversion pipe for Haile Gold Mine Creek downstream of Ledbetter Reservoir would be relocated adjacent to the relocated North Fork diversion piping, and the outlet for the Haile Gold Mine Creek diversion pipe would be similar to that shown in Figure A-40. These outfall structures would be located at the downstream end of the North Fork and Haile Gold Mine diversion pipes (red lines) shown in, among others, Figure A-44.

By the end of Mine Year 1, the North Fork diversion would be moved to the west side of the Mill Zone Pit. Flow in Haile Gold Mine Creek downstream of Ledbetter Reservoir would be diverted into pipes that would run parallel to the North Fork diversion until discharge to Haile Gold Mine Creek. See Figure A-41 for the location of the diversion modifications in place by the end of Mine Year 1.

The Haile Gold Mine Creek detention structure is expected to be constructed in Mine Year 3. This detention structure would be placed in the upper reaches of Haile Gold Mine Creek, with a structure that allows regulation of streamflow. The Haile Gold Mine Creek detention structure would be placed at the same location and as part of the crossing of the new haul road between Johnny’s PAG and Hayworth OSA. The Haile Gold Mine Creek detention structure would have the capacity to detain up to 70 percent of the 100-year precipitation event and would allow for controlled flow into the diversion pipes. Stormwater exceeding the design event would flow through the Haile Gold Mine Creek detention structure emergency spillway into Ledbetter Pit. This water would become contact water and would be pumped to the HDPE-lined 19 Pond for use at the Mill as process water, or treated at the contact water treatment plant and released. Figures A-42 and A-43 show a typical detention structure profile and cross section, respectively.

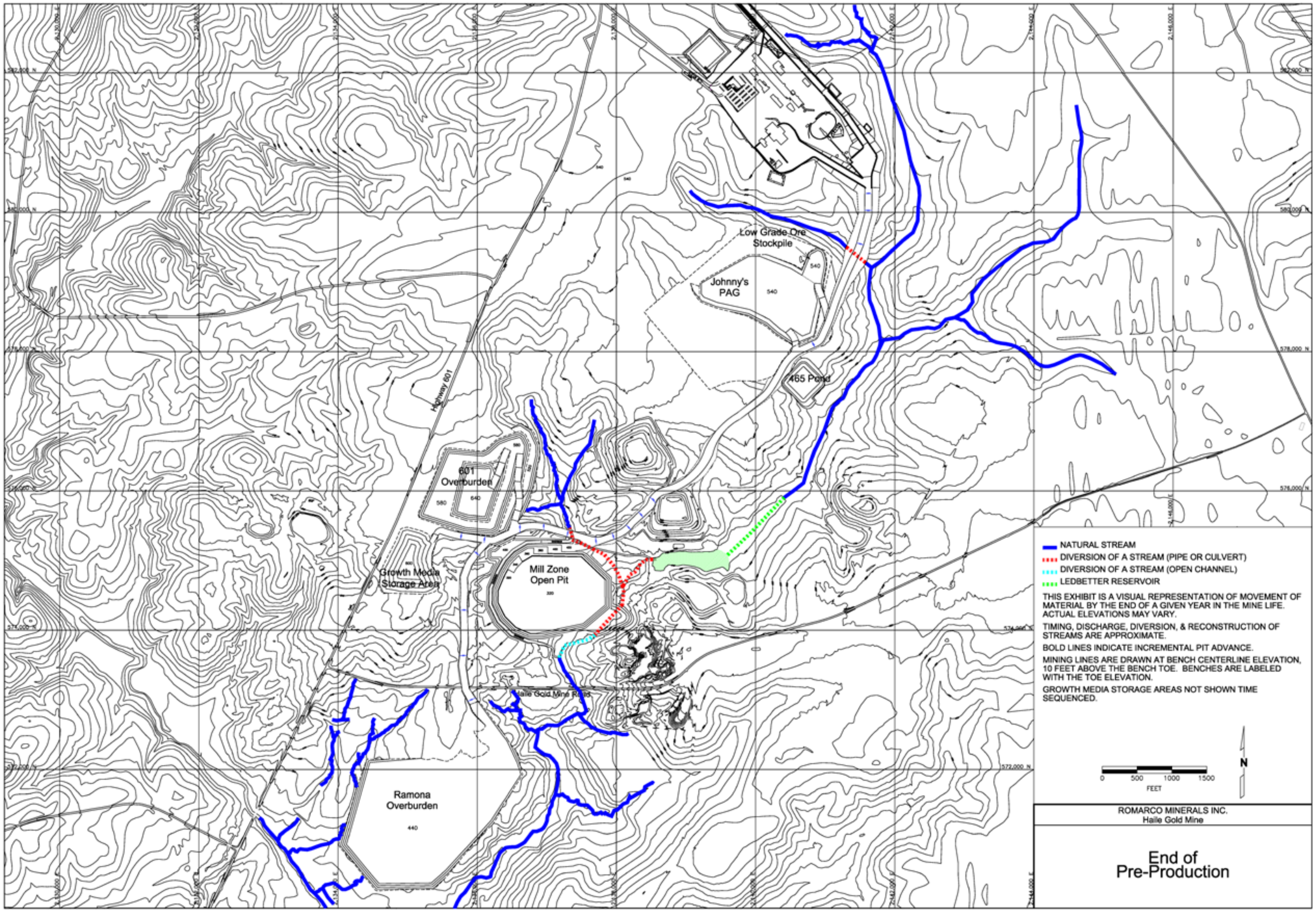


Figure A-38 Location of the North Fork Diversion Established during Pre-Production

Source: Haile 2012a (figure revised in 2013).

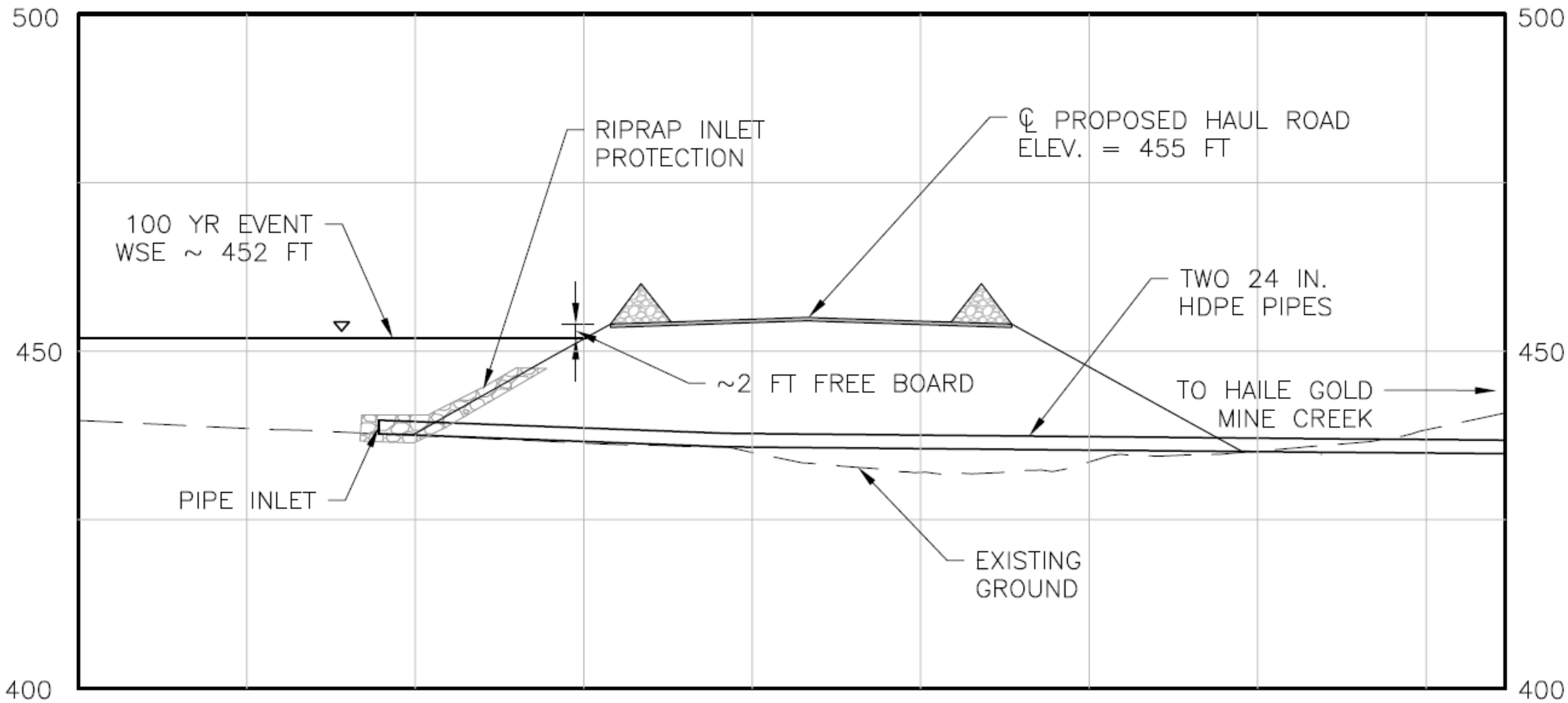


Figure A-39 General Design of North Fork Diversion Inlet

Source: Haile 2013a.

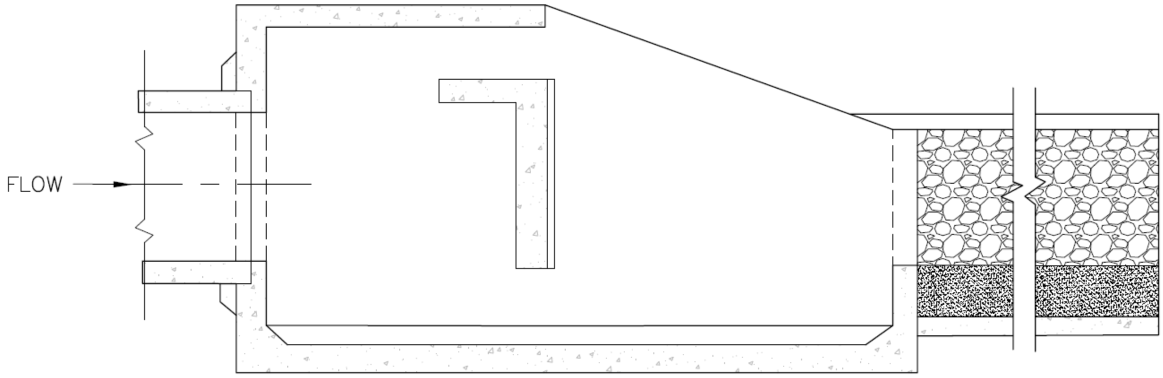


Figure A-40 Diversion Pipe Energy Dissipation

Note: Dimension of individual impact basins to follow U.S. Bureau of Reclamation sizing recommendations

Source: Haile 2013a.

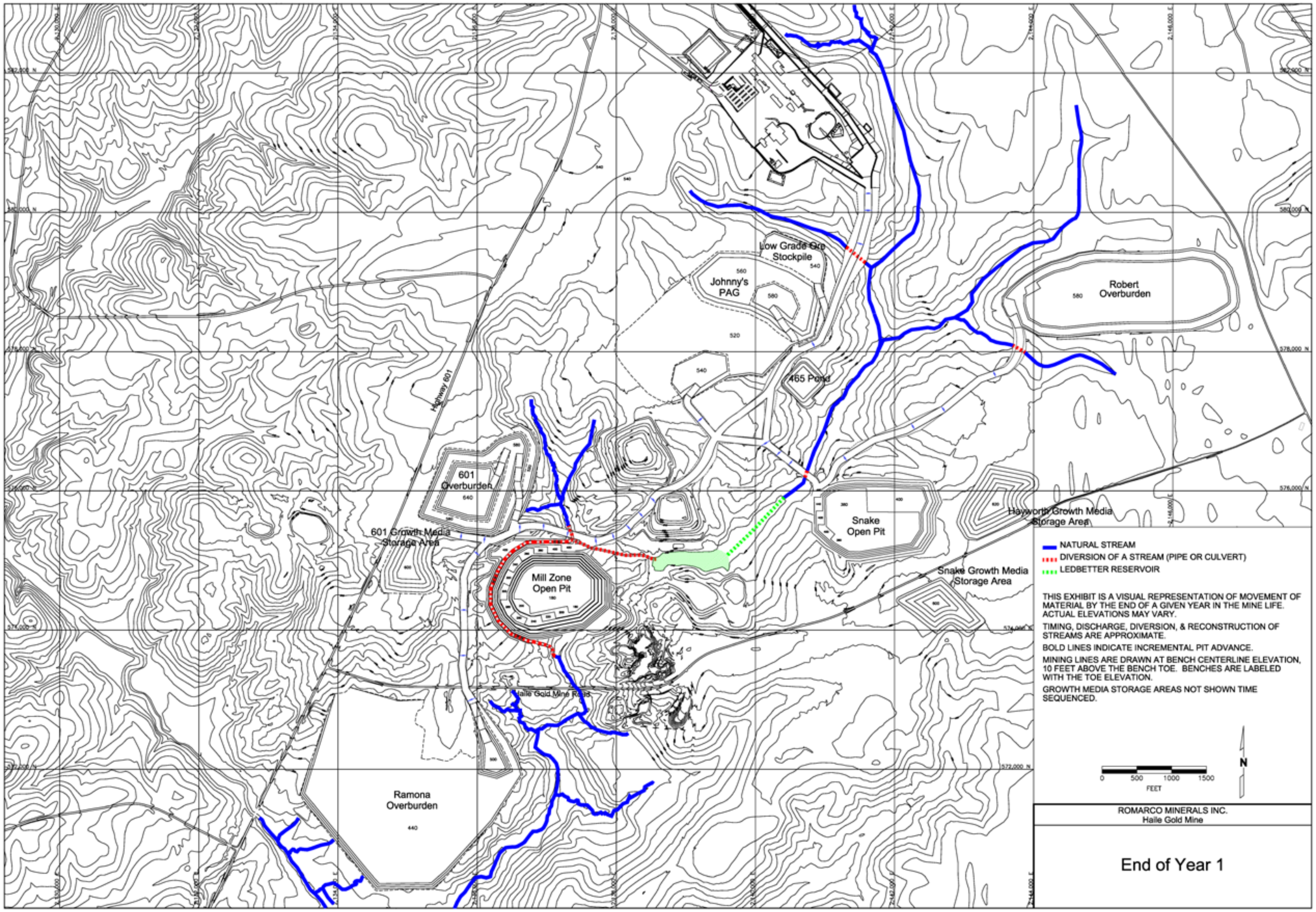


Figure A-41 Location of the Diversion Modifications in Place by the End of1

Source: Haile 2012a (figure revised in 2013).

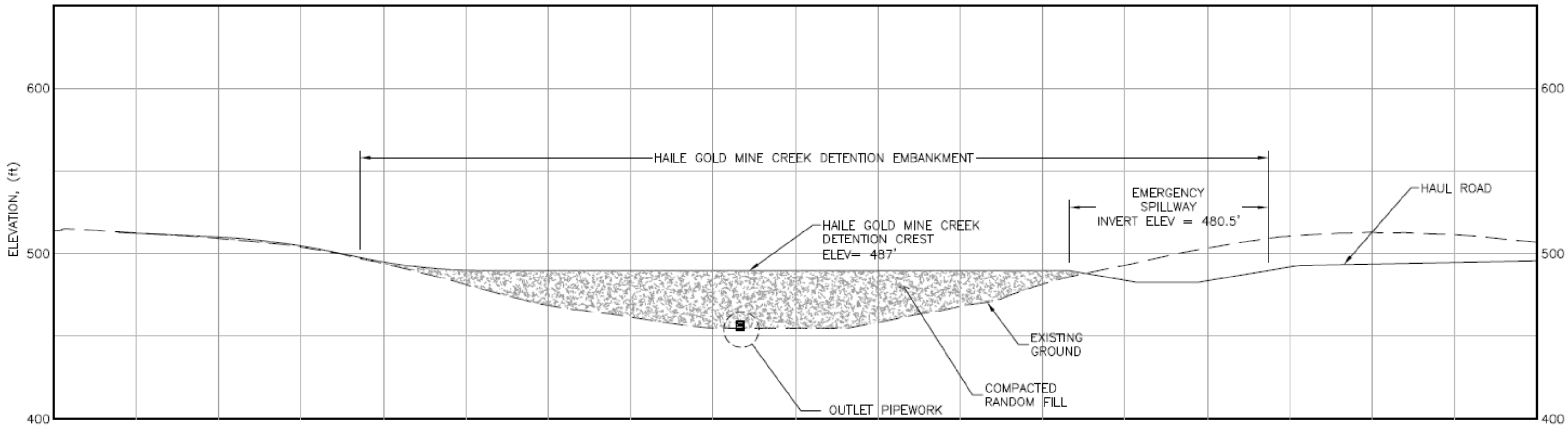


Figure A-42 Typical Detention Structure Profile

Source: Haile 2013a.

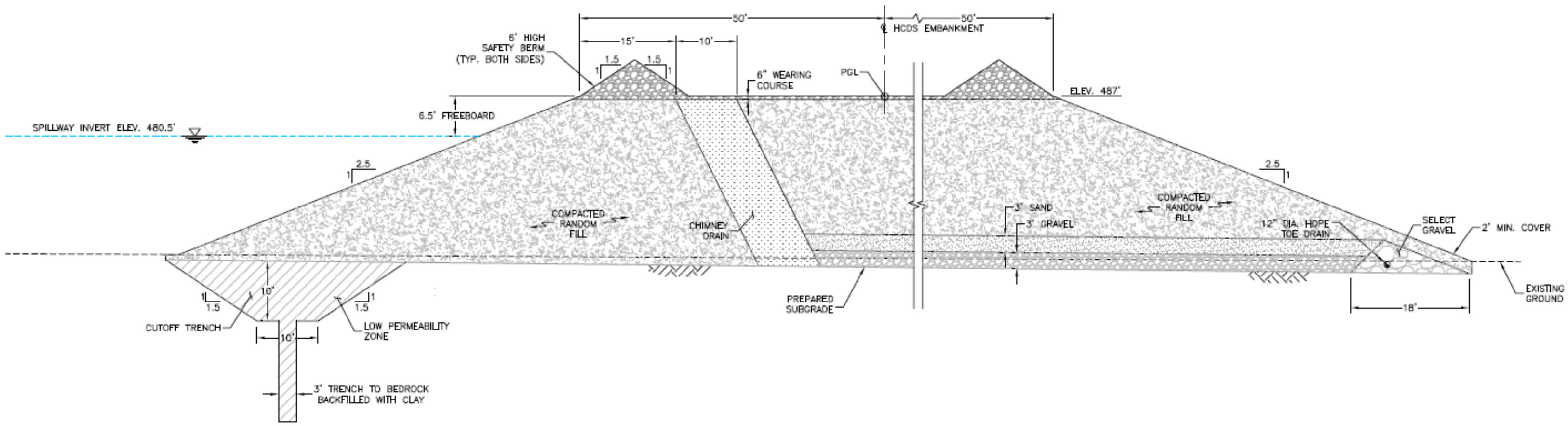


Figure A-43 Cross Section of a Typical Detention Structure

Source: Haile 2013a.

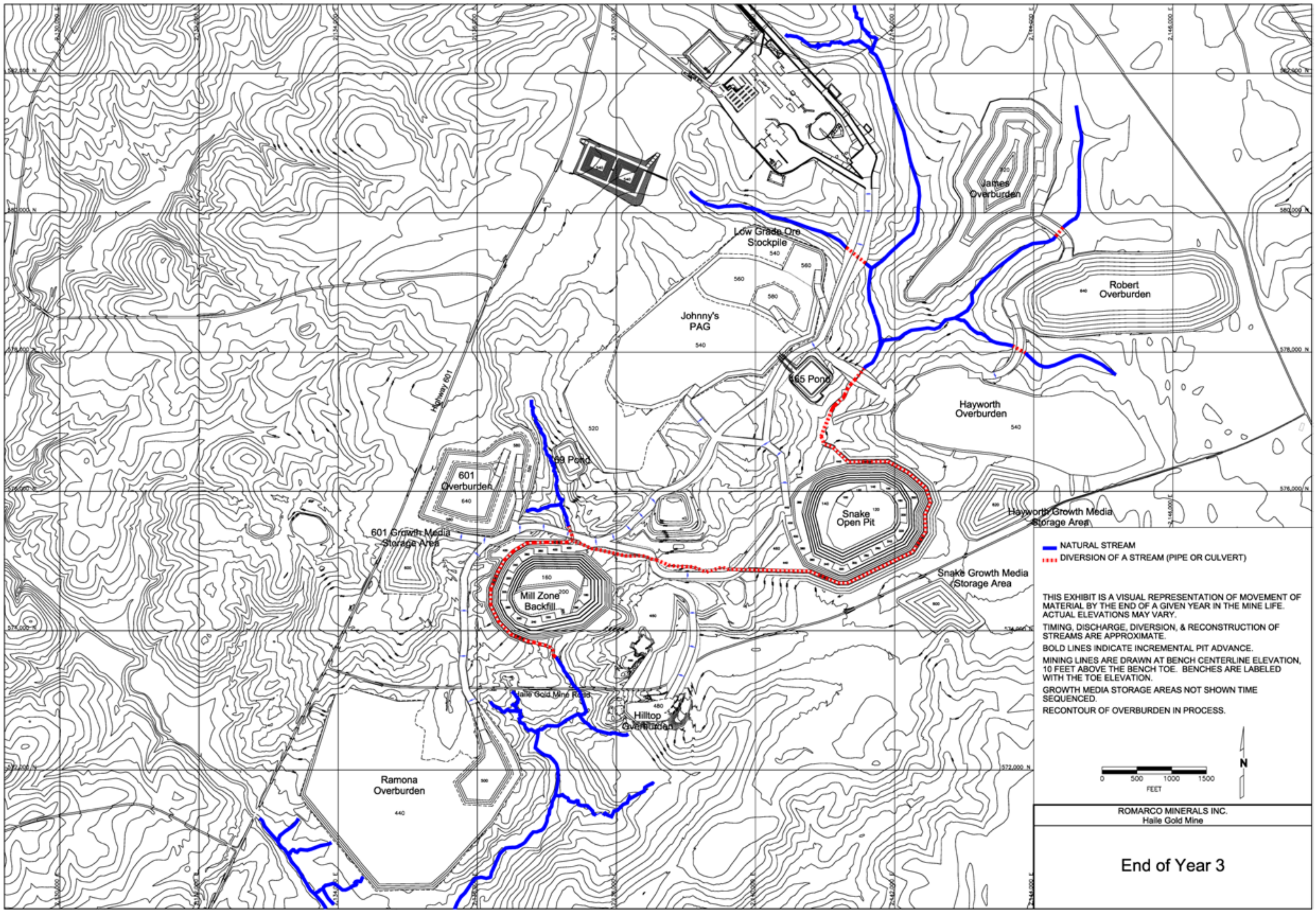


Figure A-44 Location of the Diversion Modifications in Place by the End of Mine Year 3

Source: Haile 2012a (figure revised in 2013).

During Mine Year 3, Haile expects that flow of Haile Gold Mine Creek through Ledbetter Reservoir would cease, and the diversion of Haile Gold Mine Creek around Snake Pit planned for the remaining mine life would commence. The diverted flow is expected to run through pipes that would be connected to the outlet works at the detention structure and would be routed along a wide (typically 50 feet, to accommodate service trucks along with the piping) bench along the east perimeter of the Snake Pit. These pipes would be routed from the Snake Pit past the south side of the former Ledbetter Reservoir, and they would run parallel to the North Fork diversion pipes that are around the west side of the Mill Zone Pit and then flow into the natural drainage of Haile Gold Mine Creek downstream of the active mining pits. As described in subsequent years, the diversion piping would be moved but the ultimate point of release into natural channels of Haile Gold Mine Creek would not change during mining. See Figure A-44 for the location of the diversion modifications in place by the end of Mine Year 3.

In Mine Year 4, Haile would place the final alignment of pipe from the Haile Gold Mine Creek detention structure, which would run along the southern and eastern sides of the active mining areas. The mining in the Red Hill and Haile Pits would progress to an elevation that would enable construction of the southern diversion bench, so that the Haile Gold Mine Creek diversion pipes would run from approximately 435 feet amsl on the east end to release at approximately 400 feet amsl at the natural stream grade. The diversion pipes would be relocated from the route on the south side of the former Ledbetter Reservoir and west side of the Mill Zone Pit to the new Red Hill and Haile Pit diversion bench. The North Fork diversion pipes would remain on the west side of the Mill Zone Pit. See Figure A-45 for the location of the pipe alignment that would be completed by the end of Mine Year 4.

In Mine Year 7, assuming that the location of the 601 OSA has been completely regraded and recontoured, a portion of the tributary to the North Fork that was displaced by the 601 OSA may be reconstructed. Reconstruction and reestablishment of streams on site would be governed by the Reclamation Plan approved by the SCDHEC, Division of Mining. See Figure A-46 for the location of the reconstructed portion of North Fork that would be completed by the end of Mine Year 7.

After Mill Zone Pit is backfilled, Haile expects to re-establish a stream gradient to carry the North Fork. However, restoring of the flow in the re-established stream would not be done immediately. The North Fork diversion pipe is expected to be relocated from the Mill Zone diversion bench on the west side of the pit adjacent to the newly reestablished stream gradient. See Figure A-47 for the location of the diversion modifications to the Mill Zone that would be in place by the end of Mine Year 8.

Haile expects that the North Fork streamflow would be maintained in the relocated diversion pipe for several years before removing the pipe and returning flows to the reestablished channel, after settling of backfilled locations and appropriate establishment and stabilization of a stream bed. See Figure A-48 for the location of the reestablished North Fork in place by the end of Mine Year 11.

A portion of Haile Gold Mine Creek flow (downstream of the Ledbetter Pit) that is in the diversion pipe on the Red Hill and Haile Pits diversion bench would be relocated to flow in a reconstructed stream placed over the Red Hill and Haile Pits backfilled area. This reconstructed channel is planned to join a portion of the North Fork and then flow into Haile Gold Mine Creek. The Haile Gold Mine Creek detention structure and pipes would remain in place above this reconstructed channel. The Haile Gold Mine Creek flow from upstream of the Ledbetter Pit would be split between a diversion to allow some flow into Ledbetter Pit Lake and some flow through the diversion pipes to the reconstructed stream channel. Haile would divert flow into the Ledbetter Pit Lake only as may be authorized by the SCDHEC, Bureau of Water, Surface Water Withdrawal Permitting Section standards for “safe yield” from the creek. Figure A-49 shows the location of the reconstructed channel that would be in place by the end of Mine Year 12.

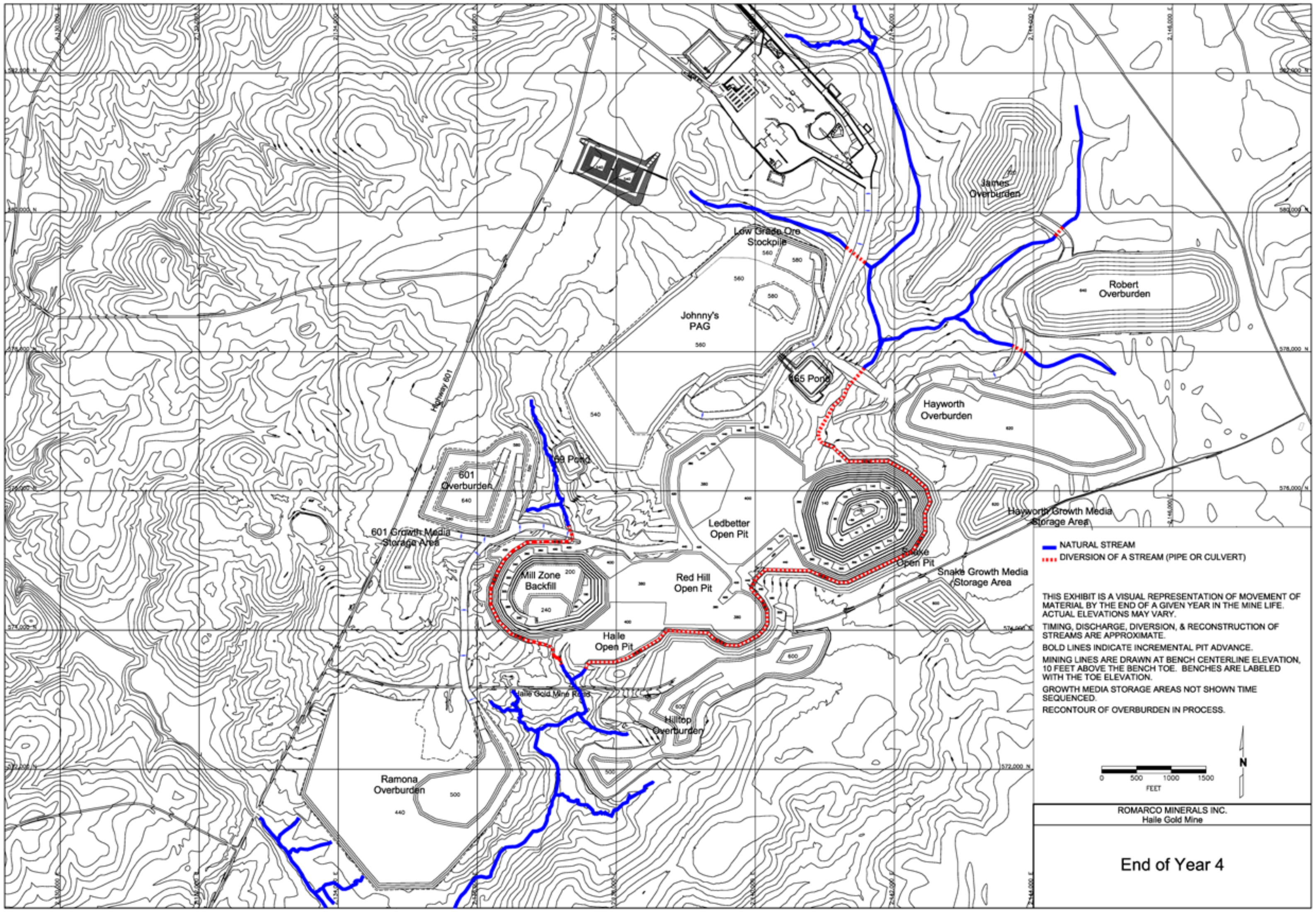


Figure A-45 Location of the Pipe Alignment in Place by the End of Mine Year 4

Source: Haile 2012a (figure revised in 2013).

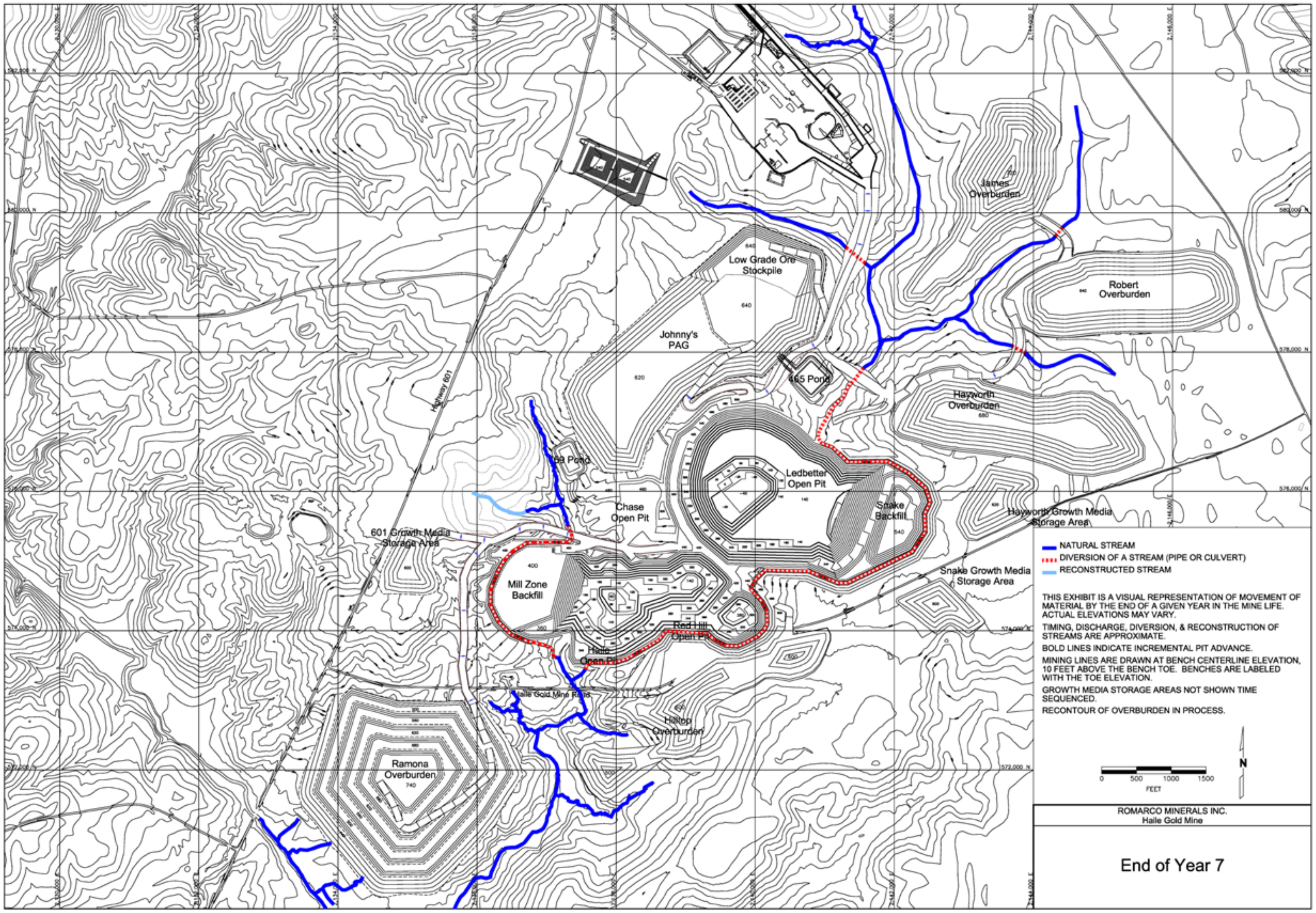


Figure A-46 Location of the Reconstructed Portion of North Fork by the End of Mine Year 7

Source: Haile 2012a (figure revised in 2013).

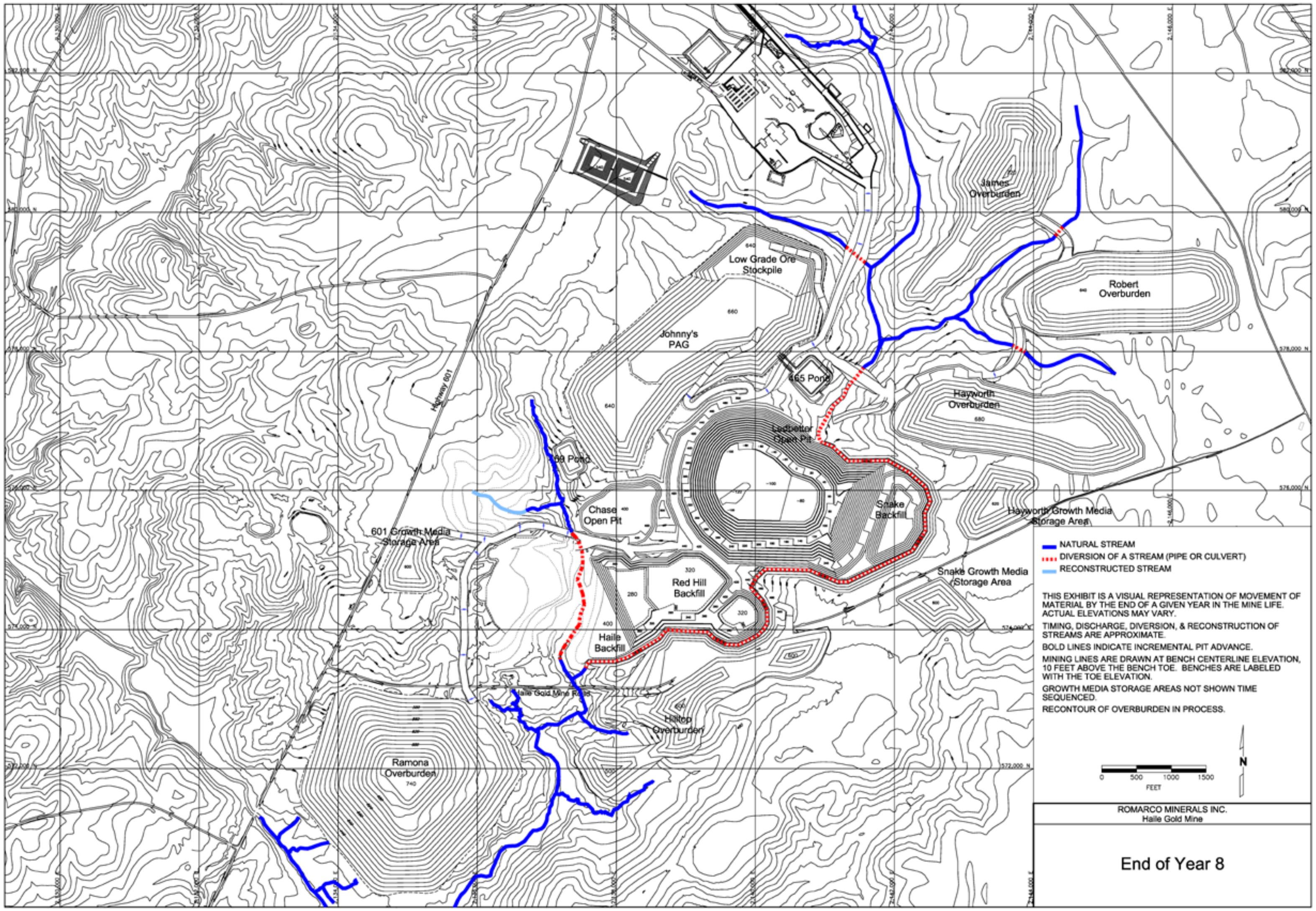


Figure A-47 Location of the Diversion Modifications to the Mill Zone in Place by the End of Mine Year 8

Source: Haile 2012a (figure revised in 2013).

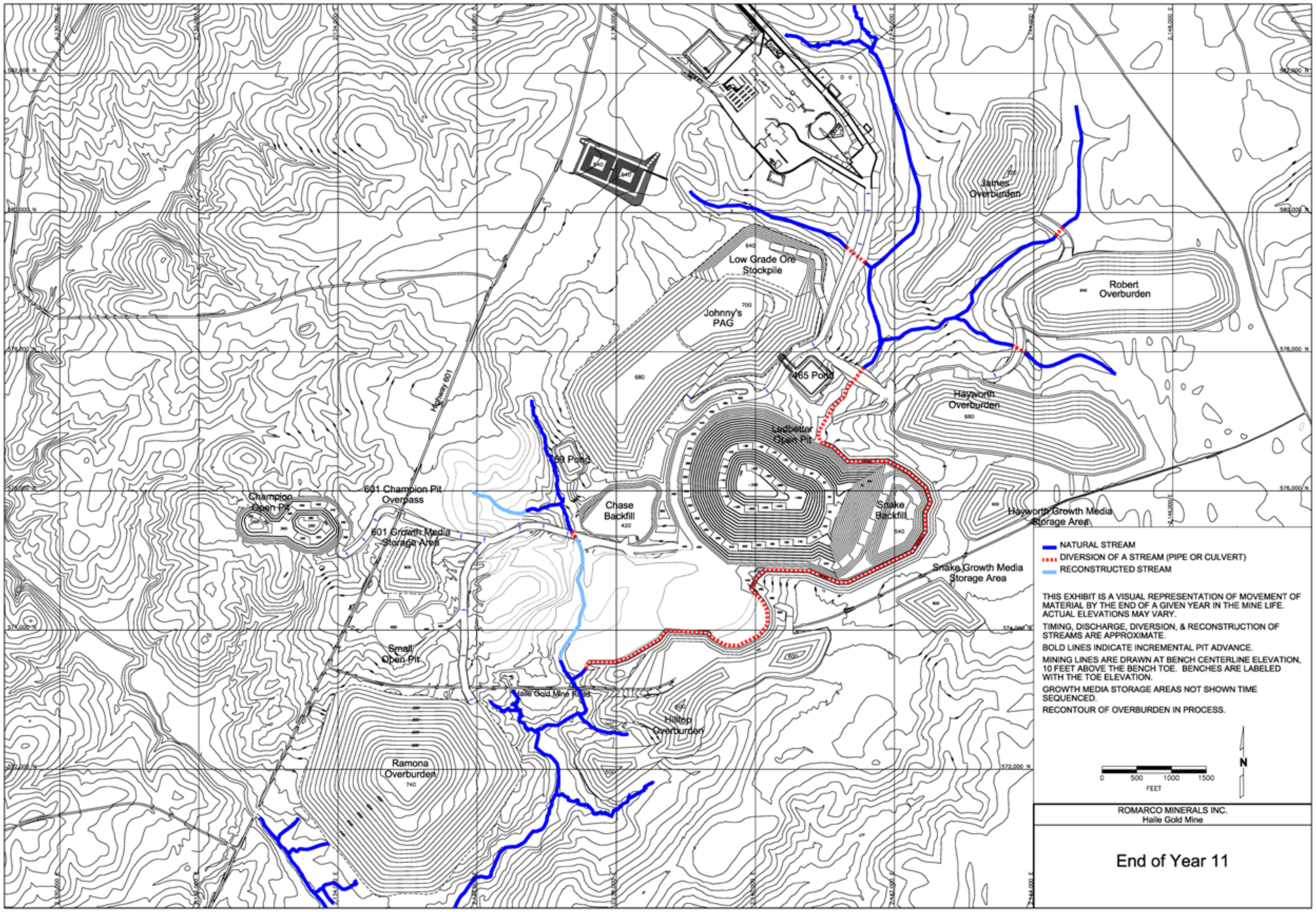


Figure A-48 Location of the Re-Established North Fork in Place by the End of Mine Year 11

Source: Haile 2012a (figure revised in 2013).

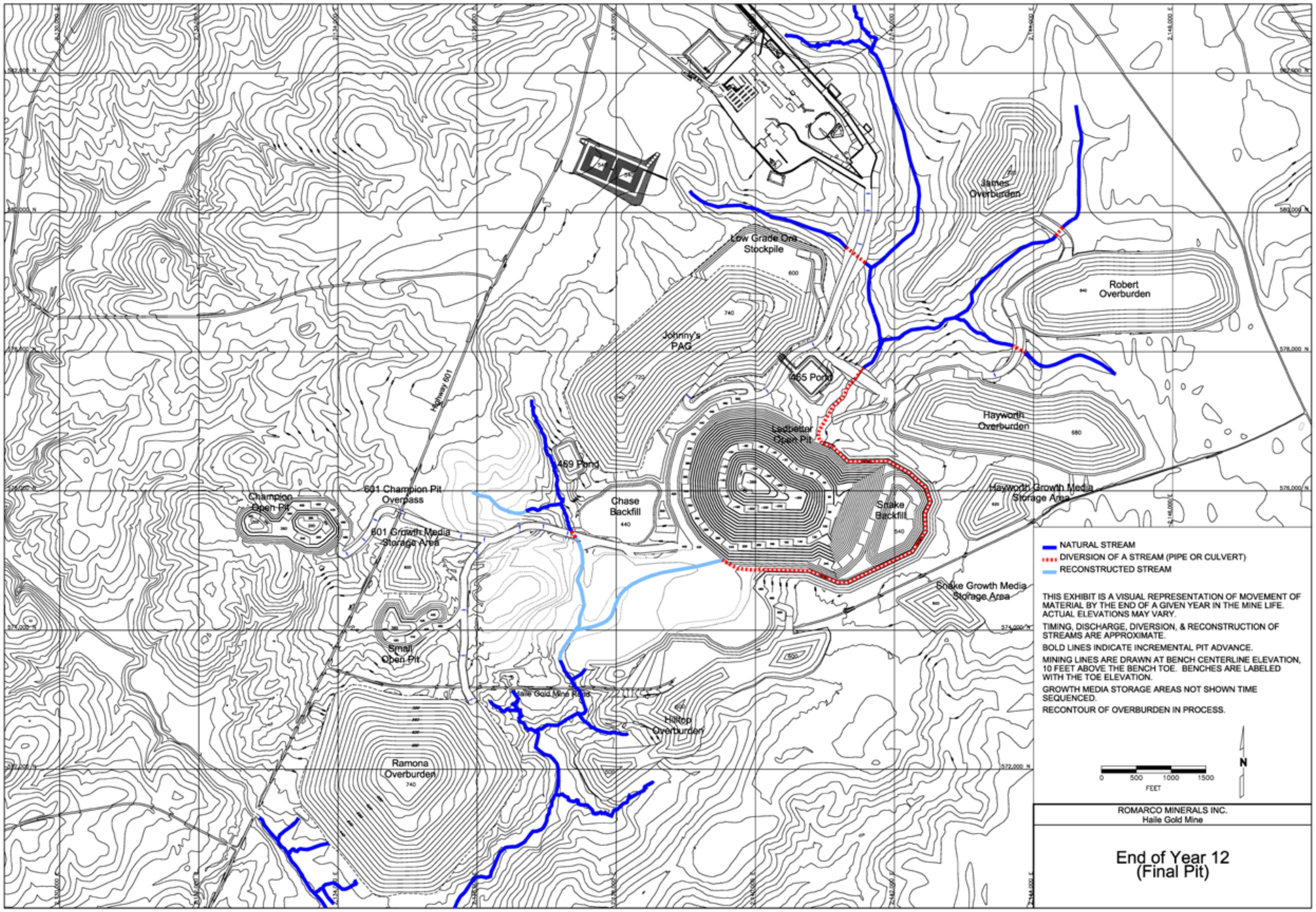


Figure A-49 Location of the Reconstructed Channel in Place by the End of Mine Year 12

Source: Haile 2012a (figure revised in 2013).

During filling of Ledbetter Pit Lake (post-mining), the Haile Gold Mine Creek detention structure would be removed and replaced with a low-head dam or modified to function as a low-head dam post-mining that would continue to divert flow into the diversion pipes consistent with the SCDHEC, Bureau of Water, Surface Water Withdrawal Permitting Section standards for safe yield. The intent of the low-head dam is to maintain, at a minimum, regulated minimum instream flows while allowing the remaining streamflows to flow into the Ledbetter Pit to expedite pit filling.

Upon filling of Ledbetter Pit Lake to equilibrium (approximately 95 percent), the low-head dam is expected to be removed, and all streamflows would flow into Ledbetter Pit Lake. Flows would exit the pit lake through an engineered outlet structure into reestablished stream channels constructed over the backfilled pits, into the Lower Haile Gold Mine Creek, and into the Little Lynches River. It is expected that filling of Ledbetter Pit Lake to equilibrium will take approximately 20 years post-mining, and the engineered outlet structure would be designed prior to this time in cooperation with the SCDHEC.

A.9.2 Contact Water

A.9.2.1 Sources of Contact Water

Contact water is water that comes into contact with PAG material, such as the overburden or low grade ore stockpile stored in Johnny’s PAG, crusher stockpile stored at the Mill, and water pumped out of pits that has come into contact with PAG material. Contact water originates from the following sources:

- Dewatering of the surface water within active and inactive pits (not reclaimed) mined into PAG material, including seepage, stormwater runoff, and pit wall runoff;
- Runoff from Johnny’s PAG; and
- Seepage from Johnny’s PAG.

Runoff and seepage from ore stockpile(s), including the low grade ore stockpile at Johnny’s PAG, and the ore stockpile at the Mill.

Contact water would be collected, stored in HDPE-lined ponds, and either used in the Mill or treated at the on-site contact water treatment plant and discharged as a point source under an NPDES permit. The design of the apron for this outfall would be similar to that shown in Figure A-37. The outfall structure would be located immediately downstream of the water treatment plant outfall, identified as Water Management Feature 8 in Figure A-36. This outfall type is appropriate for use where flow rates and pressures are low, dispersion of flow is not required, and riprap can be extended to the receiving water without additional stream or wetland impacts.

A.9.2.2 Treatment and Management of Contact Water

The proposed contact water treatment plant is designed to treat 1,200 gpm. The facility is designed to handle variable low flows efficiently. The proposed treatment approach is a two-stage clarification system to address the estimated influent metals loading from contact water generated onsite during operational activities. The water treatment process approach was selected to provide flexibility and reliability in meeting discharge permit standards for the variable flow rates and water quality from the contact water generated onsite (the inflow to the contact water treatment plant would vary, over time, in both quantity and quality). Redundancy has been provided for critical process areas and unit process equipment to ensure compliance with the NPDES permit and to better handle the variable water quality and loading, as water would have varying levels of contaminants depending on the source.

The contact water treatment plant is a 7,800-square-foot self-contained facility within the Mill Site. It is planned to be placed between the administration building and the tailing thickener area (see Figure A-21 for detail). Contact water is collected in the 19 Pond, which is a make-up source for the Mill or can be sent to the contact water treatment plant. The treatment process consists of two reaction tanks, two clarifiers, and a multi-media filtration process that is designed to precipitate the metal hydroxides into flocculated solids. These solids settle in containment compartments, are pumped to the cyanide recovery thickener, and ultimately are disposed of in the TSF. The clarified water is reused in the Mill process or discharged from the contact water treatment plant. Details of the contact water treatment plant have been provided to the SCDHEC, Bureau of Water, NPDES Permitting Section for approval.

The contact water treatment plant and associated 19 Pond were sized based on two requirements. First, the facilities were sized to ensure that the combined capacity of the contact water treatment plant and the 19 Pond were sufficient to meet the design criteria that the 465 and 469 Collection Ponds, which accept runoff and seepage from Johnny's PAG, can be emptied within a period of 72 hours after a 100-year storm event. Second, the adequacy of the treatment plant capacity and 19 Pond storage volume was evaluated based on the site-wide water balance. Detailed water balance modeling indicates that 19 million gallons of storage capacity is adequate for managing contact water in predicted consecutive wet months.

- **465 Collection Pond –** The 465 Collection Pond is double lined with an LCRS; it would collect the internal seepage from within Johnny's PAG and the runoff from the east side of Johnny's PAG. A typical LCRS is shown in Figure A-33. The pond has a capacity of 2.61 million cubic feet (19.5 million gallons), with an additional 3 feet of freeboard; it would be managed so that it would hold the runoff from a 100-year storm event. The pond is sized to be able to contain the entire 100-year, 24-hour storm volume plus 10 percent excess storage capacity. The pond is designed so that the 100-year runoff volume can be emptied in 72 hours, with water pumped to the 19 Pond for treatment and discharge or use as make-up water at the Mill.
- **469 Collection Pond –** The 469 Collection Pond is double lined with an LCRS; it would collect the seepage and runoff from the west side of Johnny's PAG. A typical LCRS is shown in Figure A-33. The pond has a capacity of 1.60 million cubic feet (12.0 million gallons), with an additional 3 feet of freeboard; it would be managed to be able to hold the runoff from a 100-year storm event. The pond is sized to be able to contain the entire 100-year, 24-hour storm volume plus 10 percent excess storage capacity. The pond is designed so that the 100-year runoff volume can be emptied in 72 hours and would be pumped to the 19 Pond for treatment and discharge or use as make-up water at the Mill.
- **19 Pond –** The 19 Pond is double lined with an LCRS; it is designed to store approximately 2.54 million cubic feet (19 million gallons) of water, with an additional 2 feet of freeboard. A typical LCRS is shown in Figure A-33. The 19 Pond is designed to be used as a buffer between the various sources of contact water and the contact water treatment plant. The 19 Pond is sized to ensure that the 465 and 469 Collection Ponds can be evacuated of runoff from the 100-year event within 72 hours, in coordination with running the contact water treatment plant. The water reporting to the 19 Pond would be treated in the contact water treatment plant or be sent to the Mill for use as make-up water.

A.10 Groundwater Management

The proposed mine pits would extend below the water table, requiring extraction of groundwater in and around the open pit to remove the hydraulic pressure on the pit walls, to prevent flooding, to stabilize the pit walls, and to promote safe mining practices during mining operations. This process is referred to as "depressurization" and involves drawing down the localized groundwater table by pumping from wells located in the vicinity of each pit before and during mining operations.

A system of pumping wells would be used to lower the water table surrounding the open pits. Depressurization of the pits would be a significant, consistent source of water throughout the Project. This water would be used for process water at the Mill and dust suppression.

The main objectives of the groundwater management system are to:

- Lower the groundwater table below the level of the working pit floors;
- Depressurize the pit slopes so that slope designs can be safely implemented; and
- Provide a source of fresh water for the Mill and dust suppression.

The depressurization systems have been planned to intercept as much groundwater as possible from the pit vicinity (depth and lateral breadth). The groundwater would be pumped using bedrock wells. The wells would be installed to intercept water before it reaches the immediate area of active mining. Figure A-50 is a generalized cross section of a mine pit with depressurization and water management features such as depressurization wells, horizontal drains, and dewatering pumps. The objective is to draw down the water table to below the operating depth of the pit, as illustrated by the dashed blue line in the figure.

Depressurization would begin prior to the start of mining in each pit and would continue through mining operations. In some cases, depressurization would continue after mining has ended to support backfilling operations and mining in nearby pits. A range of potential depressurization rates has been estimated based on numerical modeling, as described in the *Addendum to Depressurization and Dewatering Feasibility Study* (AMEC 2012). This evaluation presented groundwater production under scenarios presenting a low, a base, and a high volume of groundwater production, using available data and information on the geology and from groundwater pumping tests. Average annual depressurization rates are estimated to range from a low of approximately 880 gpm to a high of approximately 2,660 gpm. Actual rates would be determined as wells are placed and pumped during mining.

The Haile Gold Mine would hold its depressurization water in aboveground storage tanks and discharge using an outfall with apron similar to that shown in Figure A-37.

Water pumped from within active pits that has come in contact with PAG material would be (1) handled as contact water and reused in the mine process; or (2) treated through the contact water treatment plant and discharged subject to the NPDES permit that would be issued by SCDHEC, Bureau of Water, NPDES Permitting Section for the contact water treatment plant, at the permitted NPDES discharge point (AMEC 2012).

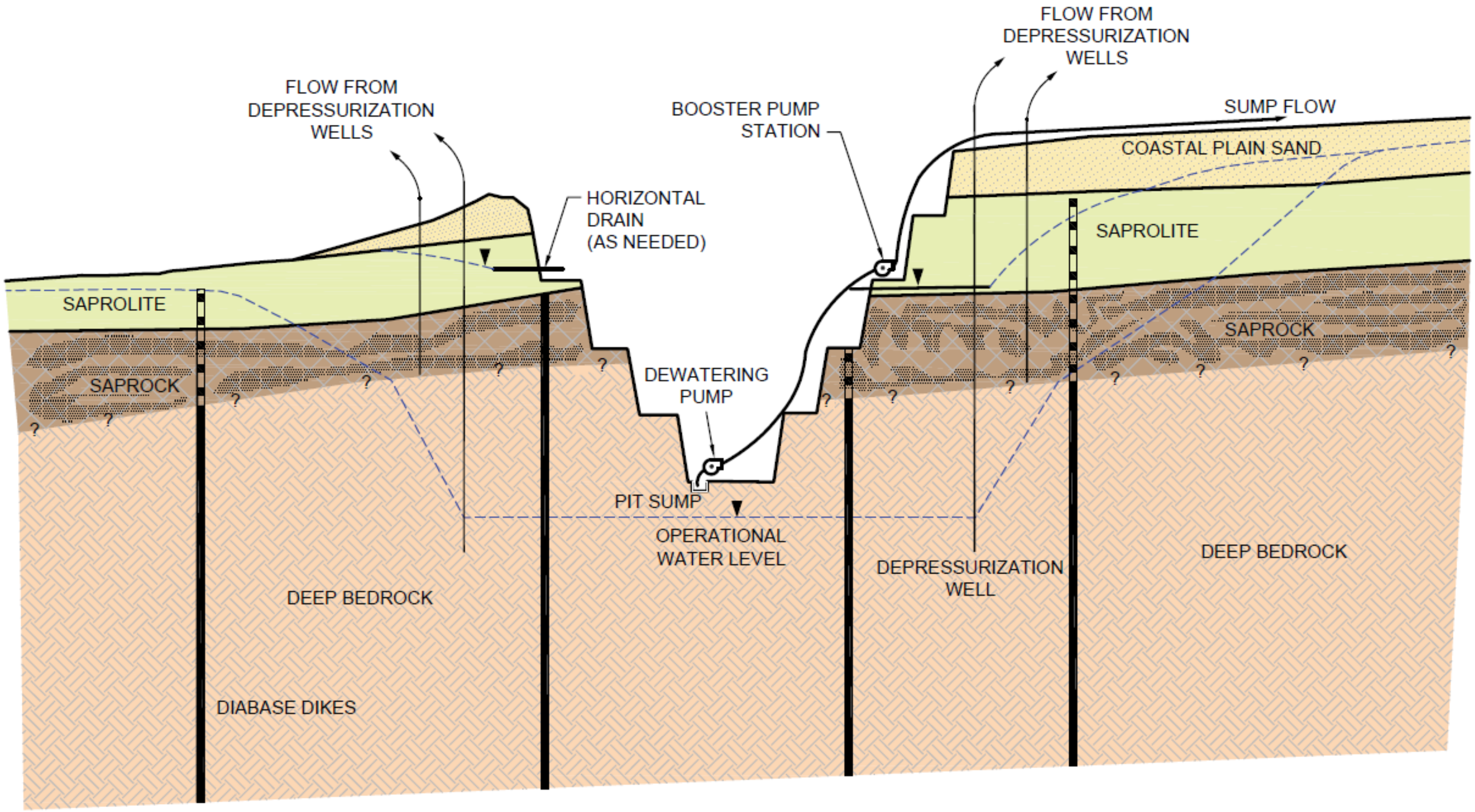


Figure A-50 Mining Pit Cross Section Showing Groundwater Depressurization

Source: Haile 2013a.

A.11 Site Reclamation

Site reclamation would occur both during mining ("concurrent reclamation") and after mining ceases ("post-mining reclamation"). The estimated schedule for reclamation is shown in Table A-2. A conceptual site reclamation plan would be reviewed and approved by the SCDHEC, Bureau of Land and Waste Management, Division of Mining and Solid Waste Management, Mining and Reclamation Program as part of the mining permit application. In concert with the Mining and Reclamation Plan, Haile would develop and have approved a Monitoring and Management Plan to continually assess the effectiveness of the reclamation and closure actions in order to detect any failures of closure structures and to initiate any required response actions to maintain environmental standards.

This summary is based on Haile's submission to the SCDHEC, Division of Mining. The proposed site reclamation plan is designed to reclaim land disturbed by mining, ore processing operations, and associated activities to a stabilized condition that would provide for the long-term protection of land and water resources, minimize the adverse impacts of mining, and support the potential post-mining land use. Post-mining reconstructed channels are designed to convey flows from the 100-year, 24-hour storm event.

During operations, certain reclamation activities would be conducted concurrent with operations. Concurrent reclamation would be performed when a portion of mining activity is complete and final reclamation can be safely performed. Final site-wide reclamation would commence upon final cessation of mining and processing operations. Final reclamation would be completed as soon as practicable after mining activities cease at the facility.

The site reclamation plan must be approved by the SCDHEC as part of the mining permit. The objective of the site reclamation plan would be to provide stable slopes, manage discharge water quality, and establish vegetation over all portions of the mine site except those areas designated as (1) post-mining pit lakes; (2) pit highwalls adjacent to the post-mining pit lakes; and (3) any roads and access areas necessary for post-mining activities and land uses. Visual observations of concurrent reclamation would be conducted at various times throughout the mine life to establish and refine appropriate vegetation species and seeding rates, soil and amendment requirements, and overall vegetation procedures to ensure sustainable post-mining vegetation for each facility type.

Reclamation falls into seven types:

- Backfilled pits;
- Pit lakes;
- Red/Yellow Class OSAs (Johnny's PAG);
- Green Class OSAs;
- Stream restoration (portions of North Fork and Haile Gold Mine Creek that were diverted prior to and during mining);
- TSF; and
- Mill Site, roads, pipelines, and other ancillary facilities (including underground utilities) not needed to support post-closure activities and land uses.

The following sections describe the proposed reclamation activities planned for each type of facility. Figures A-51 and A-52 are maps of the reclaimed Project area.

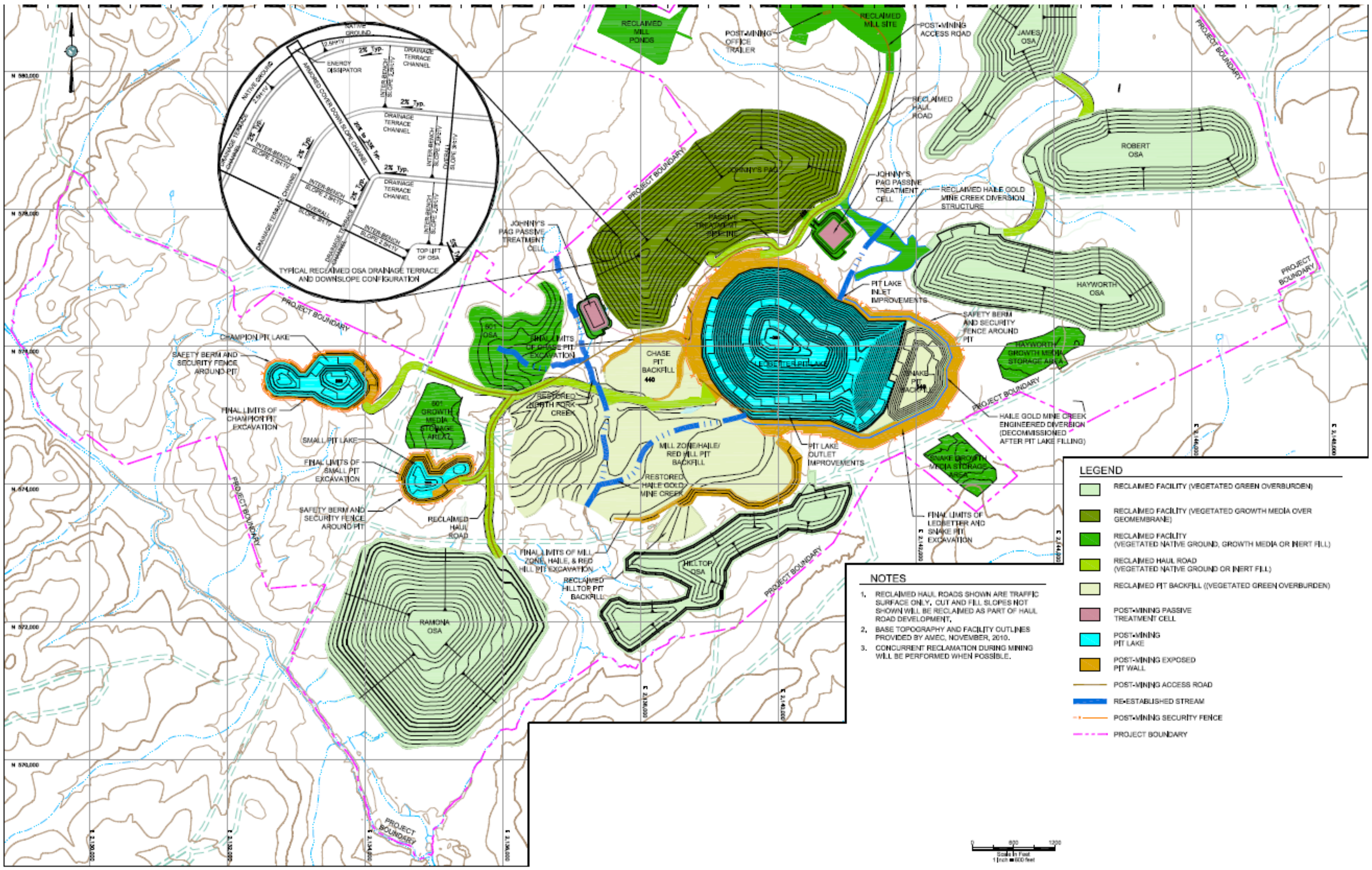


Figure A-51 Location of Pit and OSA Reclaimed Project Area

Source: Schlumberger Water Services 2010 (figure revised in 2013).

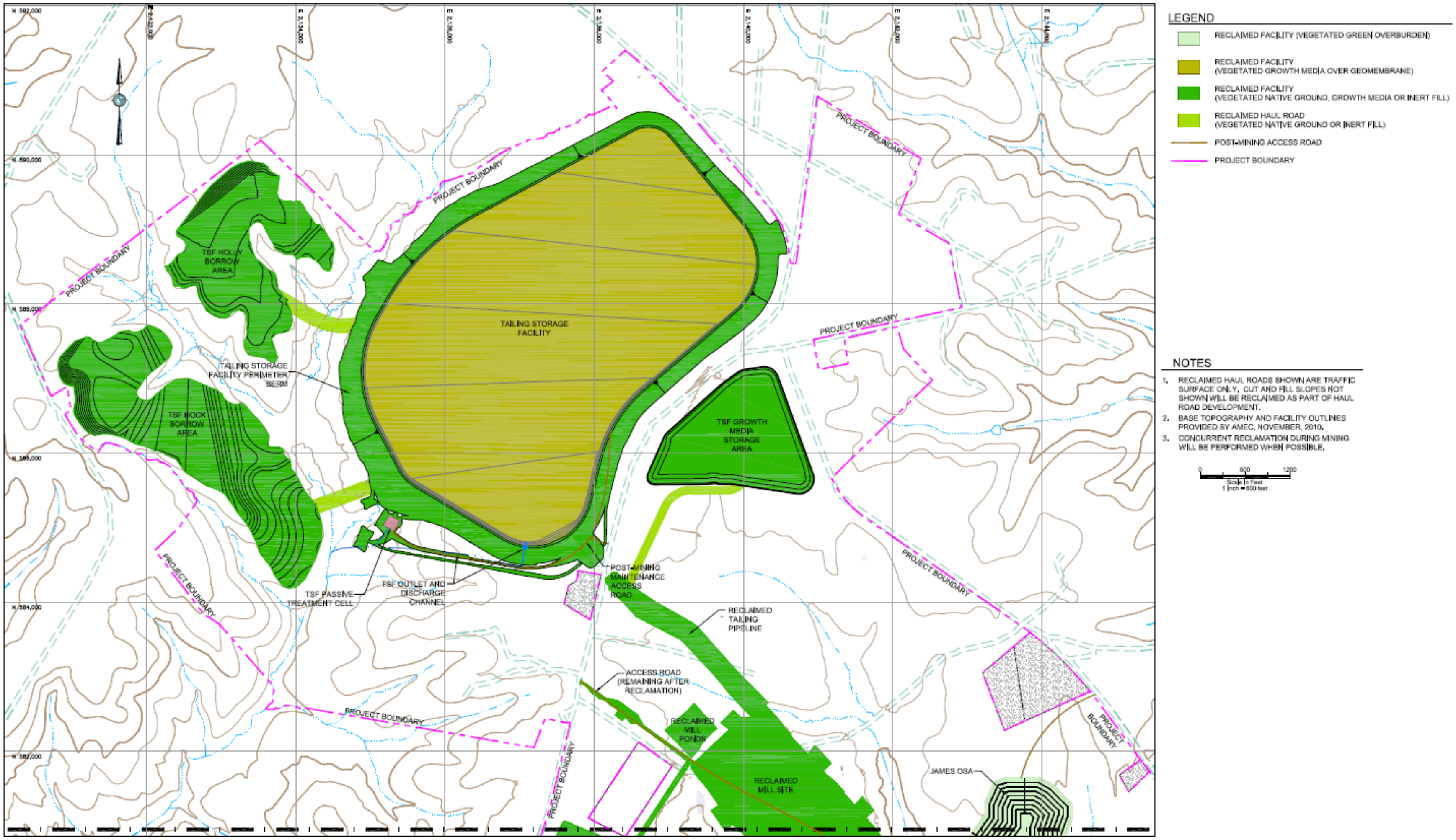


Figure A-52 TSF Reclaimed Project Area

Source: Schlumberger Water Services 2010 (figure revised in 2013).

A.11.1 Backfilled Pits

Of the eight pits included in the mine plan, four pits (Mill Zone, Haile, Red Hill, and Chase Pits) would be completely backfilled with overburden, and a fifth pit (Snake Pit) would be partially backfilled with overburden. After these pits reach planned depths, mining there would cease and the pits would be backfilled as part of overburden placement taken from mining of other pits during operations. Overburden classified as Yellow and Green Class would be placed as pit backfills. Special precautions would be taken when placing Yellow Class overburden in the pits. Yellow Class overburden would be placed in the pits up to a level to ensure that this material is permanently inundated with water following the cessation of depressurization pumping.

Inundation with water would limit the ability of the overburden material to generate acid rock drainage. Lime, or other suitable pH buffering material (referred to as *lime* or *lime amendment*), would be placed concurrently with the Yellow Class backfill. The Yellow Class backfill would be placed in discrete levels not more than 50 feet thick, and the final lift (the top of the structure) would be capped with a 5-foot layer of saprolite to limit oxygen transport into the backfilled pit. The addition of lime and construction of a saprolite layer would be performed as part of this concurrent reclamation during normal mining operations.

Green Class overburden may be placed in the pits along with or in lieu of Yellow Class overburden but would be the only class of overburden placed above the long-term inundation elevation. The placement would complete backfilling and would be designed to allow stormwater flows to run off the pit backfills. Once backfilled to the surface, the pit area would be graded, contoured with growth media, and seeded.

A.11.2 Pit Lakes

Three of the pits (Ledbetter, Small, and Champion Pits) would not be backfilled with overburden material during mining or reclamation but would be reclaimed as pit lakes. The portion of Snake Pit that is not backfilled also would be reclaimed as a lake that would become part of the Ledbetter Pit Lake. Haile Gold Mine Creek would eventually flow through the Ledbetter Pit Lake, after it fills. Haile has completed a pit lake study to predict final water levels and water quality within these pit lakes. In addition, prior to the end of active mining, another pit lake study would be performed to precisely predict final water levels and water quality of the pit lakes so as to further instruct their design plans and management. During reclamation, a security fence and/or safety berm would be established around the remaining pit highwalls. All surface water inlets or outlets to the pit lakes would be improved to limit erosion and control flow into and out of the pit lakes.

The Haile Gold Mine Creek detention structure and pipes would remain in place above the reconstructed Lower Haile Gold Mine Creek channel. However, the Haile Gold Mine Creek flow from upstream of Ledbetter Pit would be split between a diversion to allow some flow into Ledbetter Pit Lake and some flow through diversion pipes to the reconstructed stream channel. Haile would divert flow into the Ledbetter Pit Lake only as authorized by the SCDHEC, Bureau of Water, consistent with standards for safe yield from Haile Gold Mine Creek. Ledbetter Pit Lake would take approximately 20–25 years to fill, at which time all of Haile Gold Mine Creek would be redirected to flow through Ledbetter Pit Lake. During Ledbetter Pit Lake filling, the Haile Gold Mine Creek detention structure would be modified or replaced with a low head dam that continues to divert flow into the diversion pipes consistent with the SCDHEC, Bureau of Water, Surface Water Withdrawal Permitting Section standards for safe yield but also allows any flows exceeding State standards for minimum instream flow to be directed over the low head dam to fill Ledbetter Pit Lake. This would reduce the time needed to achieve stable pit lake levels and inundation of the exposed pit wall.

Because Champion and Small Pits would be the last developed, they would not be backfilled. Groundwater, rainfall, and runoff would gradually fill these lakes over a 20- to 25-year period until equilibrium water level is reached (inflows equal outflows). There would be no stream inflow or outflow from these pit lakes.

A.11.3 Johnny's PAG and Red and Yellow Class Overburden Storage Areas

During reclamation, a minimum 20-foot-thick layer of saprolite would be placed on the entire outer slope of Johnny's PAG; the saprolite layer would be covered by a 60-mil HDPE liner and 2 feet of growth media. See Figure A-53 for a cross section of Johnny's PAG after reclamation. The final lift would be covered with a 5-foot-thick layer of saprolite. The final slopes would be constructed with alternating benches and slopes with an overall slope of 3:1 to provide surface water controls to limit erosion and manage stormwater. By designing benches on the outside of the slopes, the length of stormwater flows down the side of the facility would be shortened and erosion would be minimized. The benches also provide stormwater channels for managing the flows and directing the water off the facility. Finally, the benches would be spaced so that equipment can reach areas from the bench above and the bench below, should repairs be needed on the slopes. The side slopes that have been graded would be seeded for stabilization in accordance with the Reclamation Plan approved by the SCDHEC, Division of Mining.

As noted, final reclamation of Johnny's PAG includes a 60-mil HDPE geosynthetic liner cover and a minimum of 2 feet of growth media. The growth media would be vegetated. Seepage resulting from years of the PAG being exposed to precipitation and the precipitation infiltrating the PAG material would continue to drain and collect on the HDPE liner initially placed under the PAG. This PAG seepage would continue to be collected in either the 465 or 469 Collection Pond, sent to the 19 Pond, and treated in the same manner as during the operating period. Because precipitation would be prevented from infiltrating the overburden once the cap (both the saprolite layer and the HDPE liner) is in place, the seepage from the overburden would decrease significantly in a short time.

When the seepage is reduced to a level where passive treatment systems would effectively treat these lower flows, passive treatment systems would be installed. These passive treatment systems would treat the seepage using an anaerobic (no-oxygen) treatment cell filled with organic media containing beneficial bacteria, followed by an aerobic (with oxygen) polishing treatment cell and discharge to Haile Gold Mine Creek. Design, operations, and discharge of the passive systems would be permitted through the SCDHEC, Bureau of Water, NPDES Permitting Division. The system is planned to be constructed in the lined 465 and 469 Collection Ponds. Due to the passive (no pumping) nature of the system, maintenance is expected to be minimal. The media in the cells may require replacement approximately every 25 years. Passive cell designs would be approved by the SCDHEC's NPDES Permitting Division and Mining Division. Maintenance and monitoring of the passive systems would be included in Haile's post-mining monitoring plan

Within the Project boundary, approximately 210.05 acres of wetlands and streams would remain non-impacted upon completion of the Project. Haile would observe a voluntary protective 50-foot wetland buffer area around all non-impacted wetlands and streams within the Project boundary. This 50-foot wetland buffer area is intended as a "non-disturbance" area and would not be altered from the existing condition.

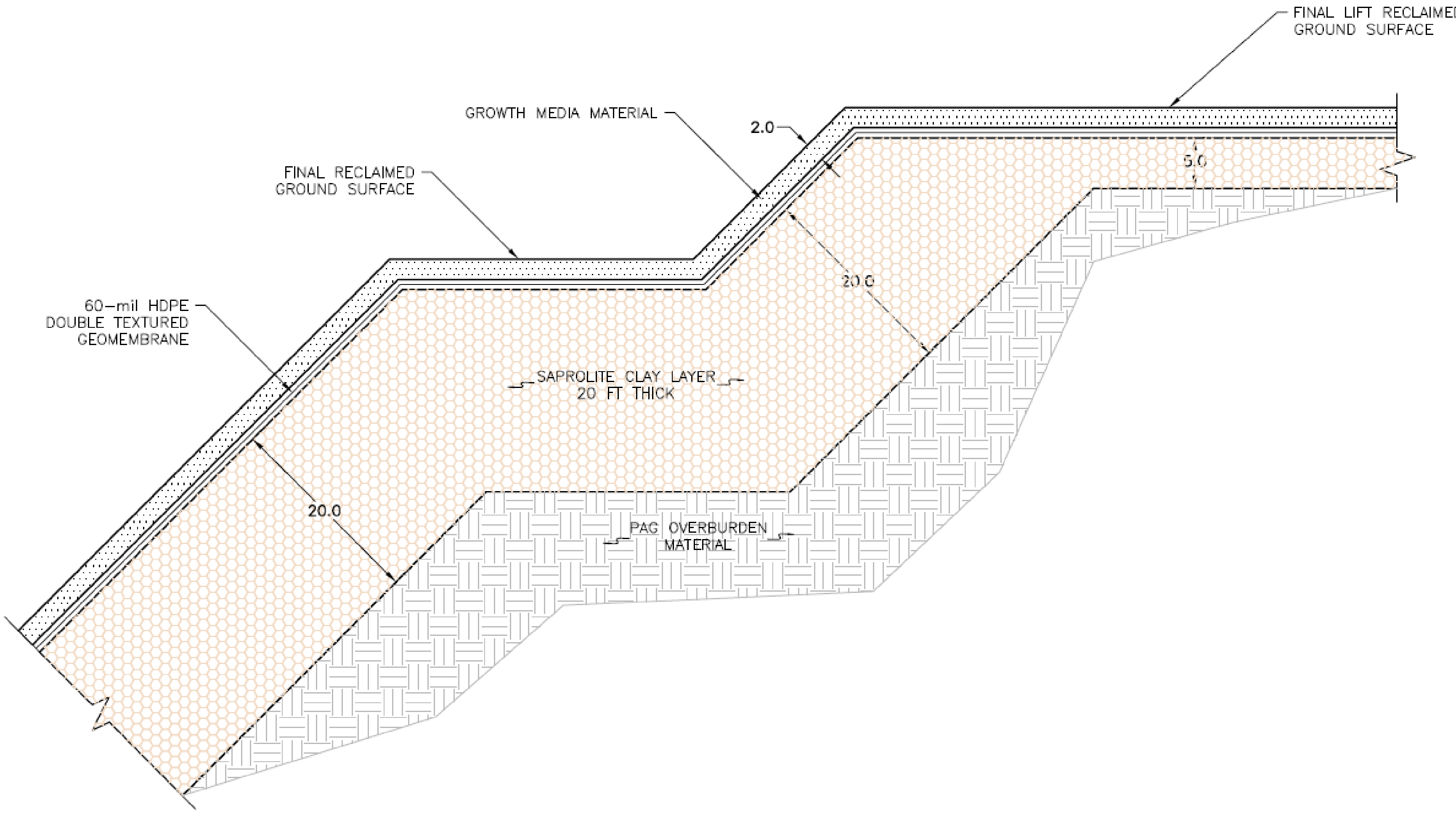


Figure A-53 Cross Section of Johnny's PAG Reclamation

Source: Haile 2013a.

A.11.4 Green Class Overburden Storage Areas

The six OSAs at the Haile Gold Mine designated to receive only Green Class overburden (601, Ramona, Hayworth, Hilltop, Robert, and James OSAs) would be reclaimed concurrently during mining as each reaches its designed capacity. Final grading of the OSAs would be alternating benches and slopes for an overall slope of 3:1. Surface water controls would be constructed to limit erosion. During reclamation, the Green Class overburden would be vegetated according to the vegetation plan contained in the Reclamation Plan that would be approved by the SCDHEC, Division of Mining.

A.11.5 Haile Gold Mine Creek

During mining operations in Mill Zone Pit and Haile Pit, North Fork Creek and Haile Gold Mine Creek would be redirected into engineered channels. Post- production, the Mill Zone Pit and Haile Pit would be backfilled to restore near-original topography in the vicinity of these two original drainages—such that North Fork Creek and Haile Gold Mine Creek would be re-established on top of the backfilled pits in Years 11 and 12, respectively.

Flow from Haile Gold Mine Creek upstream of Ledbetter Pit would be split to allow some flow into Ledbetter Pit Lake and some flow through existing diversion pipes to the reconstructed stream channel. Flow from Haile Gold Mine Creek would be diverted into the Ledbetter Pit Lake only as authorized by the SCDHEC, Bureau of Water consistent with standards for safe yield. The Haile Gold Mine Creek detention structure would be modified or replaced with a low head dam that continues to divert flow into the diversion pipes but also allows any flows exceeding State standards for minimum instream flow to be directed over the low head dam to fill Ledbetter Pit Lake. This would reduce the time needed to achieve stable pit lake levels and inundation of the exposed pit wall.

Once full, the entire flow of Haile Gold Mine Creek would be redirected to run through Ledbetter Pit Lake. The low head dam would be removed, the area reclaimed, and that portion of Haile Gold Mine Creek restored shortly after Ledbetter Pit Lake is completely filled.

A.11.6 Tailings Storage Facility

As the exterior slopes of the TSF achieve final configuration, they would be vegetated in accordance with the Reclamation Plan approved by the SCDHEC, Division of Mining. At the completion of mining and ore processing, the TSF would consist of an above-grade, lined impoundment, filled with tailings material and unused process water.

The TSF would be reclaimed using a dry closure approach that focuses on isolating the tailings material and limiting the infiltration of water into the tailings. TSF process water would continue to drain down within the tailings fill material and any remaining water absorbed, evaporated, or removed via the underdrain collection system to the TSF Underdrain Collection Pond, where it would be pumped to the contact water treatment plant that would be modified, if necessary, to treat this type of water. Treatment and discharge of this water source would require a new or modified NPDES permit. Prior to cessation of ore processing, Haile would initiate permitting for this water source through the SCDHEC, Bureau of Water, NPDES Permitting Division. This active draindown and water treatment system would continue until the flows have reduced to a level where a passive system can be utilized for long-term water management.

In the final months of ore processing, the tailings would be deposited in the TSF in a manner that promotes positive draining of the tailings pond. Specialized equipment designed for working in soft soils would be used to achieve final grading contours. As the surface of the tailings is stabilized and shaped for stormwater management, a 60-mil HDPE geosynthetic liner would be placed over the tailings in stages. A minimum of 2 feet of growth media would be placed over the geosynthetic liner, and the entire area would be vegetated using established procedures. This complete closure process may be achieved in sections beginning at the higher elevation (Duckwood Road side) and progressing downward to the TSF Reclaim Pond side (lower elevation) as the tailings material stabilizes sufficiently for safe equipment usage. Stabilization of the entire TSF and complete placement of cover would take approximately 5 to 10 years after final tailings deposition. During this time, stormwater runoff from the partially covered TSF basin would be managed within the basin of the TSF and treated along with the drain-down water from the TSF Underdrain Collection Pond. Stormwater would not be allowed outside the TSF basin until the stormwater was completely isolated from the tailings surface.

Once the surface of the TSF has been successfully reclaimed, water could freely drain off the covered and reclaimed tailings surface without contacting the tailings. Surface water controls would be established at the spillway outlet location to prevent erosion of the embankment during periods of high flow. Drain down would continue to be collected in the TSF Underdrain Collection Pond and treated as specified in the new or modified NPDES permit. Once the cover is in place, draindown from the TSF would decrease significantly over time as the tailings approach ultimate consolidation within approximately 20 years. Once draindown has been reduced sufficiently, a passive treatment cell, using an anaerobic treatment, would be constructed in the lined TSF Underdrain Collection Pond. This passive treatment cell would provide long-term management from the TSF with minimal maintenance requirements.

A.11.7 Mill Site, Roads, Power Lines, Pipelines, and Other Facilities

Other facilities at the mine—including the Mill Site, growth media storage areas, sediment and settling ponds, roads, power lines, pipelines, and surface water controls—that are not required for post-mining monitoring or maintenance and not needed for post-mining land use would be demolished and salvaged, or removed, and the sites would be regraded. All areas would be graded to promote drainage and growth media would be placed, if needed, to support vegetation. All disturbed areas would be vegetated in accordance with the Reclamation Plan approved by the SCDHEC, Division of Mining (Schlumberger Water Services 2010).

A.11.8 Maintenance and Monitoring

The Haile Gold Mine would require maintenance and monitoring after active reclamation work is completed, as required by the SCDHEC, Division of Mining and other active permits issued by the SCDHEC. Haile would follow the Monitoring and Management Plan (see Appendix G), which describes the requirements for monitoring and management of various environmental resources. This would include monitoring surface water and groundwater, as well as stormwater runoff, from the reclaimed areas (Table A-2). The TSF would require monitoring during draindown in addition to monitoring for a period of at least 10 years following completion of draindown. Periodic maintenance of drainage and treatment systems also may be required during post-mining monitoring. Actual monitoring requirements would be set by the SCDHEC, Division of Mining, but Haile would be monitoring the site for decades after active mining ceases.

In addition to general site monitoring and maintenance, passive treatment cells would require replacement approximately every 25 years, or as necessary. Groundwater and surface water samples would be collected and analyzed. The passive treatment cells would require periodic maintenance until untreated drainage comes within permit standards. Monitoring and replacement of water treatment systems would be carried out in accordance with SCDHEC regulations.

A.12 Future Uses of the Site

After reclamation, the site would be suitable for various uses. Because of the HDPE liner in the reclamation design, woody growth would be managed on the TSF and Johnny's PAG. The remaining property could be used for recreation, agriculture, or more intense land development (e.g., industrial, office or residential development) because utility infrastructure would be available. Figure A-54 provides a potential land use suitability map provided by the Applicant (Haile 2013b).

A.13 Wetlands Impacts

Figure A-55 illustrates the presence of wetlands and streams in the Project area and the anticipated direct impacts from proposed Project activities. Sections 3.6 and 4.6 in the main volume address "Wetlands and Other Waters of the United States" in more detail.

Approximately 120.5 acres of wetlands and 26,461 linear feet of streams would be disturbed during construction and operations of the Project. In its August 2012 Section 404 permit application, as part of the direct impacts, Haile sought authorization to disturb an additional 50-foot area from the perimeter of mine facilities and features as designed. As explained in that permit application:

All direct impacts for this analysis have assumed an additional 50 foot disturbance area around all facilities beyond the planned "footprint" of the activity. The additional 50 foot disturbance area extends from the outermost edge of the activity or facility (daylight or last grade line). While this additional disturbance area may not be directly impacted as part of any activity (fill or excavation), it has been assumed as part of this analysis as a direct impact associated with potential incidental access, potential variation or modifications upon final construction, design, construction implementation needs and/or BMP control measures that may be needed. (Haile 2012c).

In other words, the direct impact area for wetlands and streams per the August 2012 Section 404 permit application includes the impact area affected by the designed facility footprint plus an additional 50-foot disturbance area. In operations, Haile would try to avoid activities within this additional 50-foot disturbance area; however, as conditions may require, these assumed additional impact areas are treated as disturbed in the August 2012 Section 404 permit application.

The direct wetland and stream impacts would be mitigated through implementation of an approved wetlands mitigation plan.

Figure A-56 illustrates the 50-foot buffer at wetlands and streams and the assumed additional 50-foot disturbance area calculated for the Section 404 permit application.

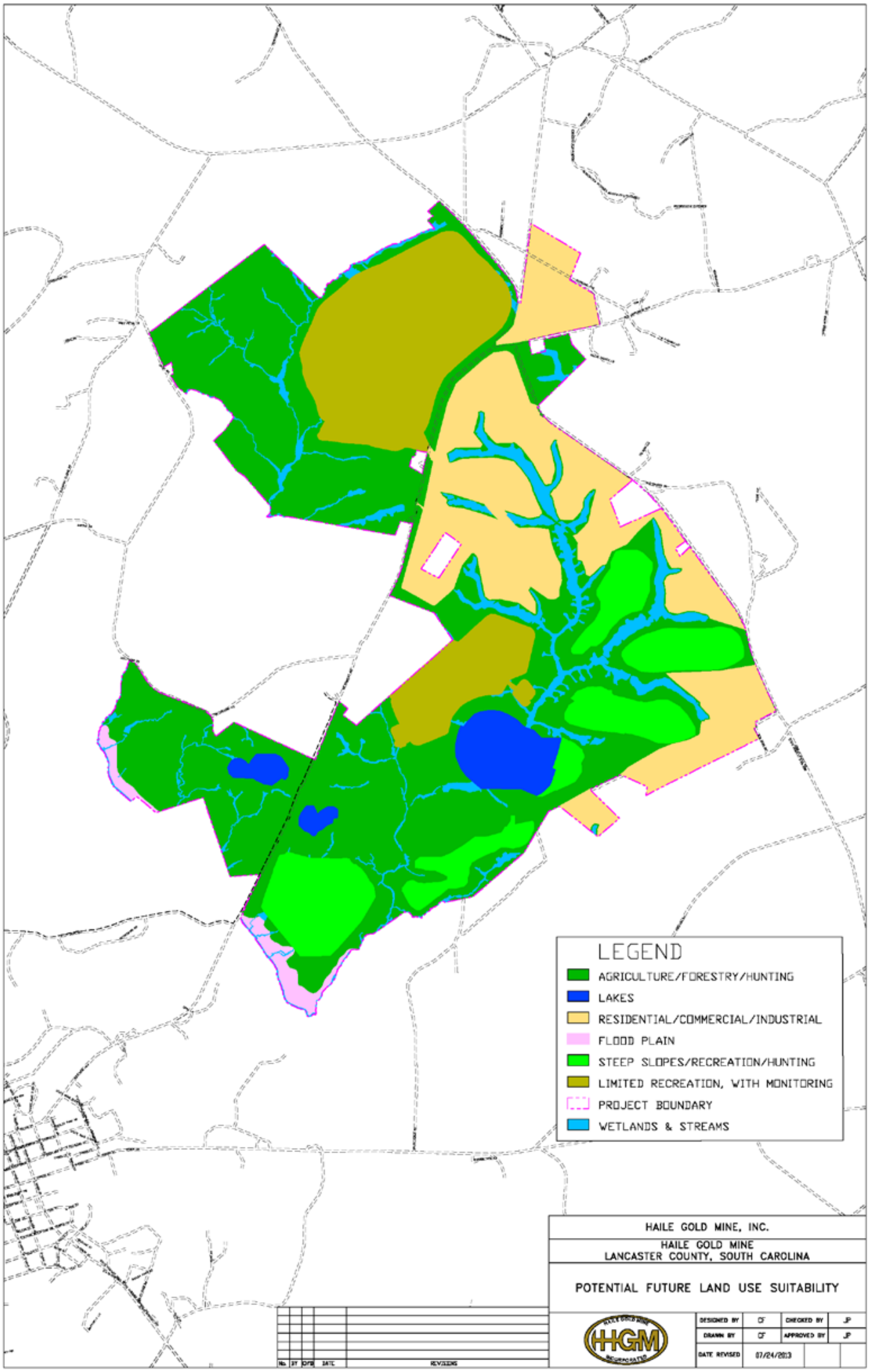


Figure A-54 Potential Future Land Use Suitability Map

Source: Haile 2013b

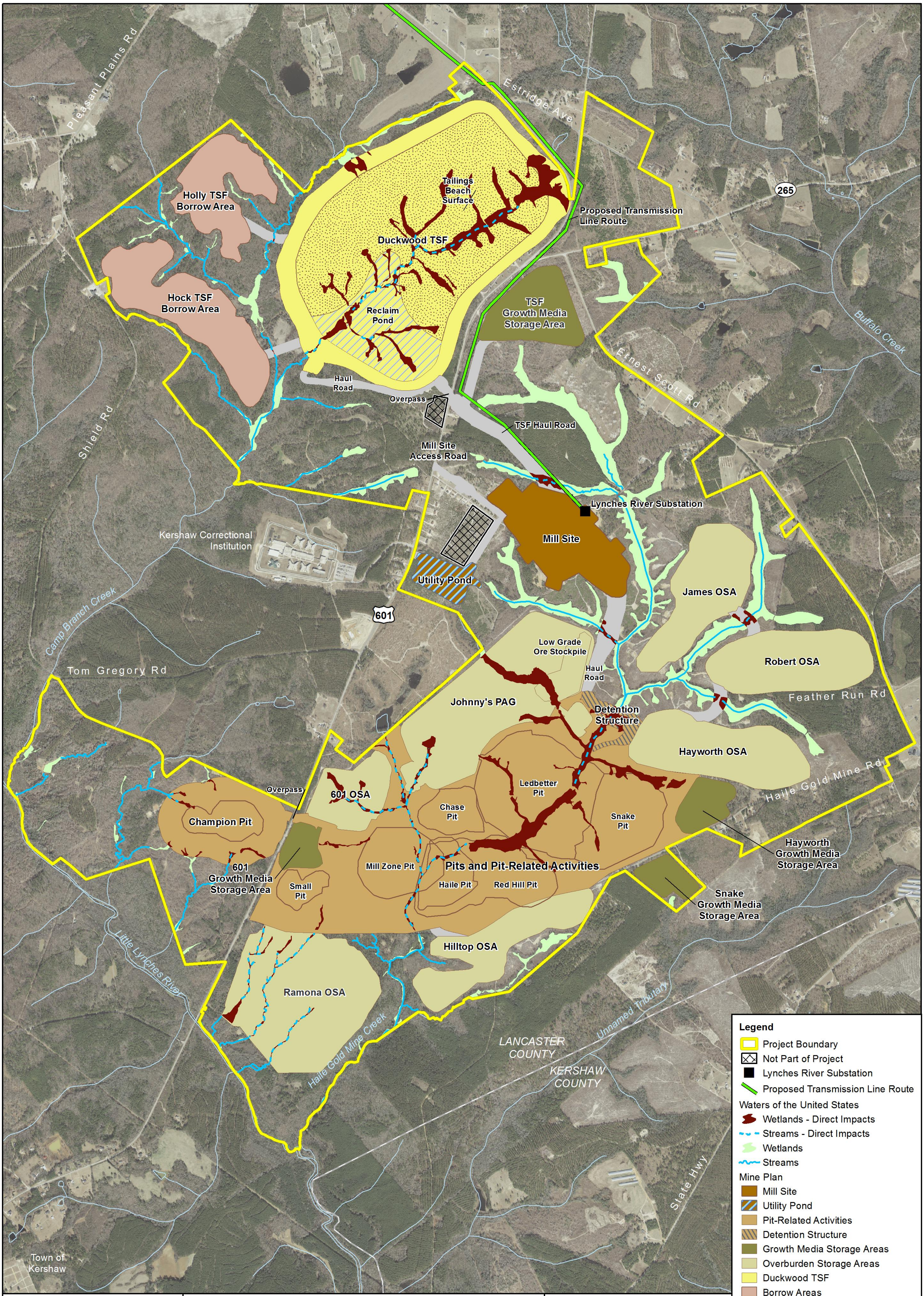


Figure A-55

Wetlands and Streams Affected by the Proposed Project

This page is left blank intentionally

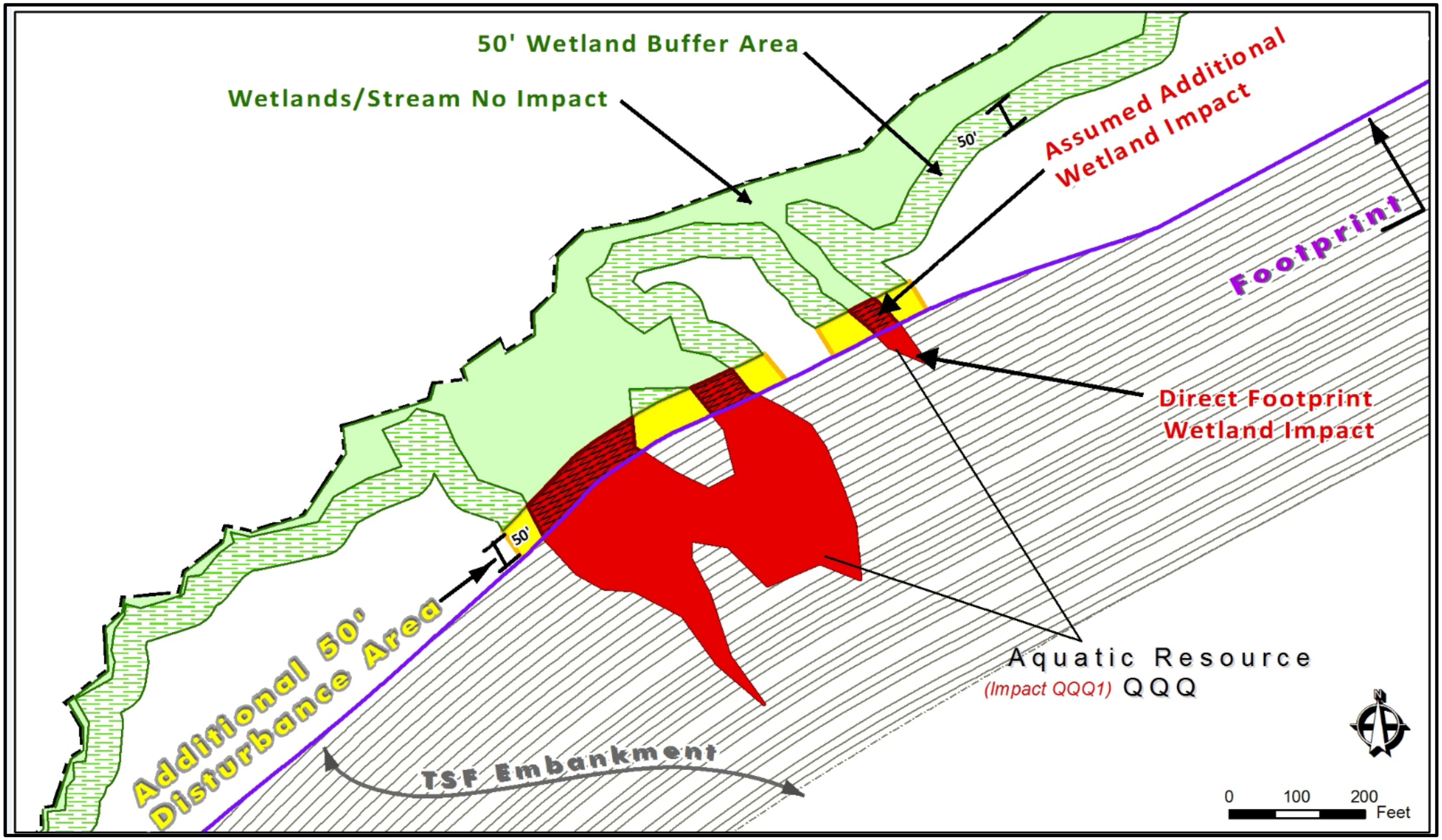


Figure A-56 50-Foot Buffer at Wetlands and Streams and the 50-Foot Assumed Additional Disturbance Area

Source: Haile 2013a.

A.14 Literature Cited

AMEC. See AMEC Environment & Infrastructure.

AMEC Environment & Infrastructure. 2012. Addendum to Depressurization and Dewatering Feasibility Study. June 27.

American Meteorological Society. 1959. Glossary of Meteorology. R.E. Huschke. (Ed.). Boston, MA.

AMS. See American Meteorological Society.

Caterpillar. 2012. Website: http://www.cat.com/cda/layout. Accessed February 2012.

Ecological Resource Consultants, Inc. 2012. Site Wide Water Balance Report. June.

ERC. See Ecological Resource Consultants, Inc.

ESRI. 2008. Data and Maps. Website: www.esri.com. Accessed February 2013.

Haile. See Haile Gold Mine, Inc.

Haile Gold Mine, Inc. 2010. Mining Method Description. In Appendix G-1 of the U.S. Department of Army Permit application.

Haile Gold Mine, Inc. 2012a. Anticipated Mine Production and Operations Report. December 12.

Haile Gold Mine, Inc. 2012b. Dam Construction Permit Application to South Carolina Department of Health and Environmental Control. August 31.

Haile Gold Mine, Inc. 2012c. Revised Clean Water Act Section 404 Permit Application to U.S. Army Corps of Engineers. August 14.

Haile Gold Mine, Inc. 2013a. Revised Project Description – Response to Additional Information Requested in Appendix A, February 22.

Haile Gold Mine, Inc. 2013b. Potential Land Use Suitability Map. July 7.

M3 Engineering &Technology Corporation. 2010. Haile Gold Mine Project Volume II: Project Description Feasibility Study, December 29.

M3 Engineering &Technology Corporation. 2012a. Technical Report, NI-43-101. March 12.

M3 Engineering &Technology Corporation. 2012b. Supplemental Analysis to the Mill Process Description and Process Flow Sheet. February 28.

NAIP. See National Agriculture Imagery Program.

National Agriculture Imagery Program. 2011. Website: http://datagateway.nrcs.usda.gov/. Accessed February 2013.

Newmont Mining Corporation. 2012. Newmont Mining Video (MP4) provided by Haile Gold Mine, Inc. May.

Romarco Minerals, Inc. 2011. Annual Report, 2011.

SCDHEC. See South Carolina Department of Health and Environmental Control.

Schafer Limited, LLC. 2012. Second Addendum to the Baseline Geochemistry Report. March.

Schlumberger Water Services. 2010. Haile Gold Mine Reclamation Plan. December.

South Carolina Department of Health and Environmental Control. 2005. Stormwater Management Handbook. July 31.

University of South Carolina. 2012. The Economic Impact of the Haile Gold Mine on South Carolina: A Regional Analysis. Moore School of Business, Division of Research, August.

A.15 Water of the U.S. Direct Analysis Detailed Plan

Haile provided the *Haile Modified Alternative General Layout* plan sheets as an updated modification to the 2011 Mine Plan submitted as part of the revised DA Permit Application (January 11, 2011). The *Haile Modified Alternative General Layout* plan sheets are included in the pages that follow.

This page is left blank intentionally.

NOTES:

1. NOTES apply to all Sheets.

2. The Haile Modified Alternative General Layout presents an updated modification to the 2011 Mine Plan submitted as part of the Permit Application (Revised January 11, 2011). The Modified Alternative General Layout (2012 Modified Plan), developed by AMEC dated May 2012, represents a mine plan that has addressed specific concerns received during the Permit Application review process to maximize avoidance and minimization measures associated with disturbance to waters of the US.

3. Maps herein depict the proposed mine facilities, major existing roadways for orientation and aquatic resources.

4. Property Boundary now includes approximately 4,552.25 acres of land. Exclusion Areas shown within the Property Boundary are not currently owned by Haile and therefore are not included in the total Property Boundary acreage.

5. Jurisdictional waters of the US, depicted as Aquatic Resources, are per the Ecological Resource Consultants, Inc. Jurisdictional Determination Request Wetland Delineation Report, Haile Gold Mine Project (SAC 1992-24122-4IA), Lancaster County, South Carolina, Revised – August 2012 (ERC 2012). The waters of the US mapping herein and that of ERC 2012 reflects the final field verification by the USACE Conway Office on July 24-25, 2012. The Jurisdictional Determination (JD) was approved by the USACE in a letter dated October 1, 2012. All Aquatic Resource mapping, both wetlands and streams, should be considered final based on the August 2012 Revised JD.

6. All jurisdictional Aquatic Resources are depicted on the maps herein, however only identification labeling has been provided for those Aquatic Resources that are associated with direct impacts. Refer to ERC 2012 for complete Aquatic Resource identification. On this Detailed Plan, the Stream Reach ID does not designate the starting point of the direct stream impact; it only denotes the starting point of the entire stream reach as delineated in ERC 2012.

7. Direct impacts are assumed to be those activities which may result from excavation, fill, or physical loss of waters of the US. Potential indirect impacts to waters of the US are not considered as part of this analysis.

8. All direct impacts for this analysis have assumed an additional 50 foot disturbance area around all facilities beyond the planned "footprint" of the activity. The additional 50 foot disturbance area extends from the outermost edge of the activity or facility (i.e., daylight or last grade line). While this additional disturbance area may not be directly impacted as part of an activity (i.e., fill or excavation), it has been assumed as part of this analysis as a direct impact associated with potential incidental access, potential variation or modifications upon final construction design, construction implementation needs and/or BMP control measures that may be needed. A 450 foot direct disturbance area has been assumed around the outer edge of the proposed Champion Pit activity anticipated pit shell to allow for operational flexibility plus an additional 50 foot disturbance area extending 50 feet from the outermost edge of the activity has been assumed, for a total disturbance area of 500 feet around the outer edge of the proposed Champion Pit.

SHEET TITLE (1 of 2) - **Revised November 2012**

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067

NOTES (continued):

9. A 50' wetland buffer area is maintained around all non-impacted wetlands and streams within the Project Boundary. This buffer area is intended as a "no-disturbance" area and will not be altered from the existing condition.

10. Table 1 - Aquatic Resource Direct Impact Summary provides a detailed analysis of determined direct impacts grouped within each Impact Area of the 2012 Modified Plan. Impact Areas have been designated based on each primary facility footprint and include the determined direct impacts of each Aquatic Resource. The Impact ID refers to a discrete impact within each Aquatic Resource and Reach corresponding to ERC 2012. Cowardin Classification refers to US Classification of Wetlands and Deep Water Habitats of the US (Cowardin et. al 1979) as determined in ERC 2012. Total Impact (acres) refers to the area of wetland and reservoir/open water calculated within each Impact ID area. Total Impact (linear feet) refers to the linear length of non-vegetated channel or stream calculated within each Impact ID area. Stream area has been excluded from total wetland area.

11. Schematic cross-sections are only intended as approximate visual representations.

Detailed Plan Includes:

- SHEET TITLE (1 of 2) - Revised November 2012
- SHEET TITLE (2 of 2) - Revised November 2012
- SHEET OVERALL SITE LAYOUT
- SHEET OVERVIEW (1 OF 3)
- SHEET OVERVIEW (2 OF 3)
- SHEET OVERVIEW (3 OF 3)
- SHEET TABLE 1 (PAGE 1 OF 4)
- SHEET TABLE 1 (PAGE 2 OF 4) - Revised November 2012
- SHEET TABLE 1 (PAGE 3 OF 4) - Revised November 2012
- SHEET TABLE 1 (PAGE 4 OF 4)
- SHEET KEY
- SHEET KEY (A)
- SHEET KEY (B)
- SHEET 1-15 (PLAN VIEWS)
- SHEET 16-30 (SCHEMATIC CROSS SECTIONS)

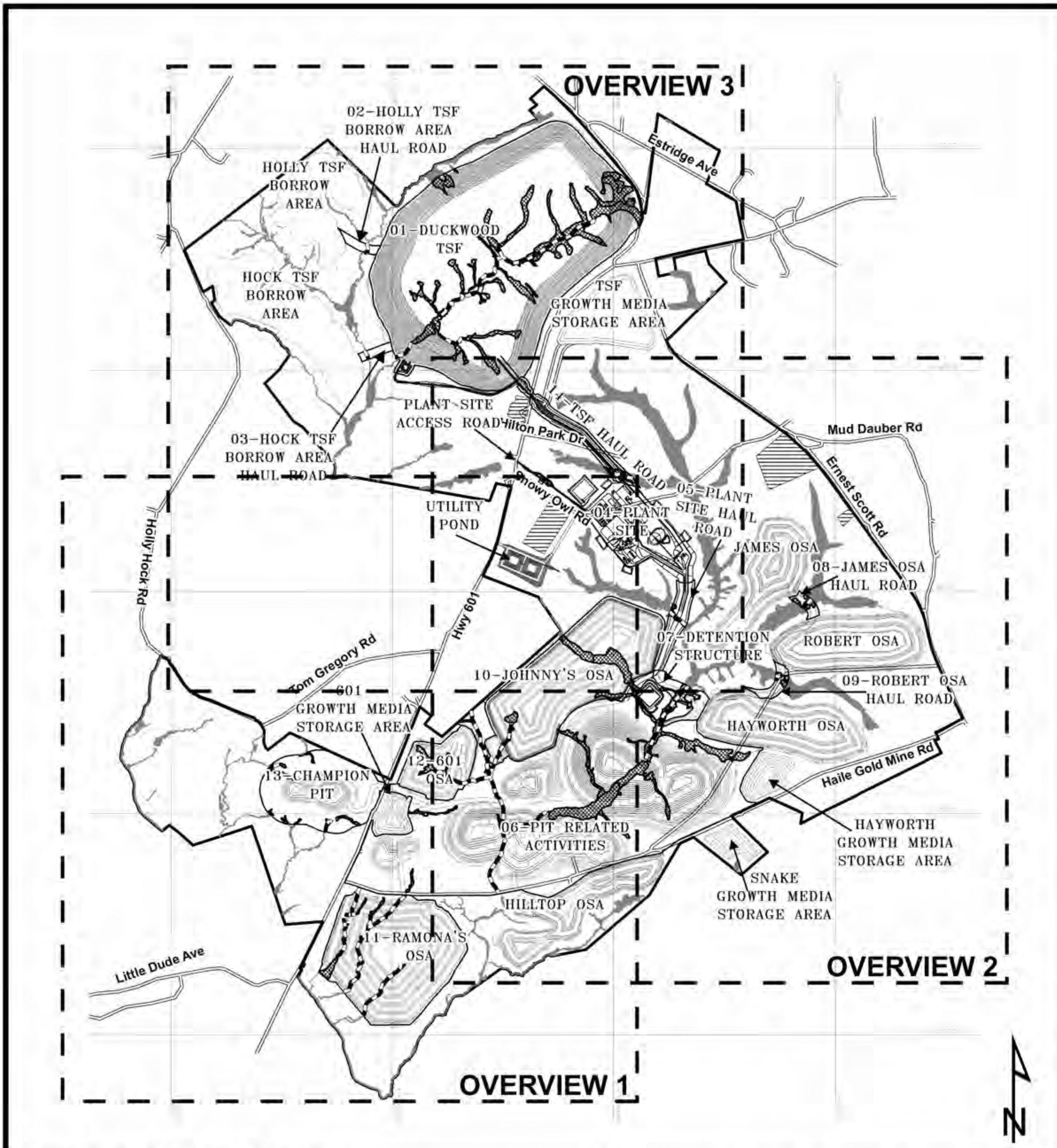
SHEET TITLE (2 of 2) - Revised November 2012

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SHEET OVERALL SITE LAYOUT

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

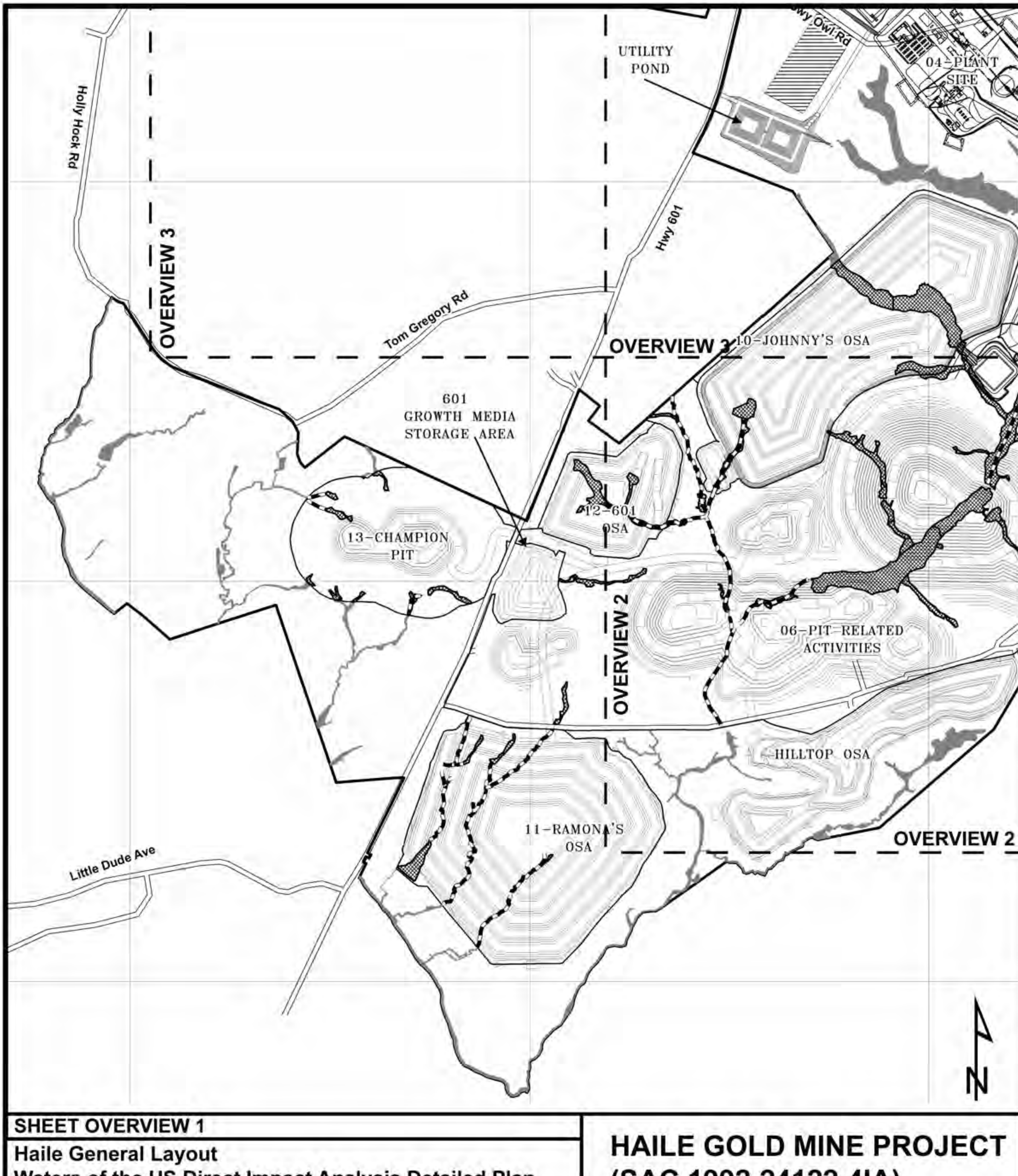
Legend

- Property Boundary
- Stream Impact
- Wetland Impact
- Exclusion Area
- Wetland/Stream
- Overview Sheet Match Line

0 1,500 3,000 Feet

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SHEET OVERVIEW 1

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

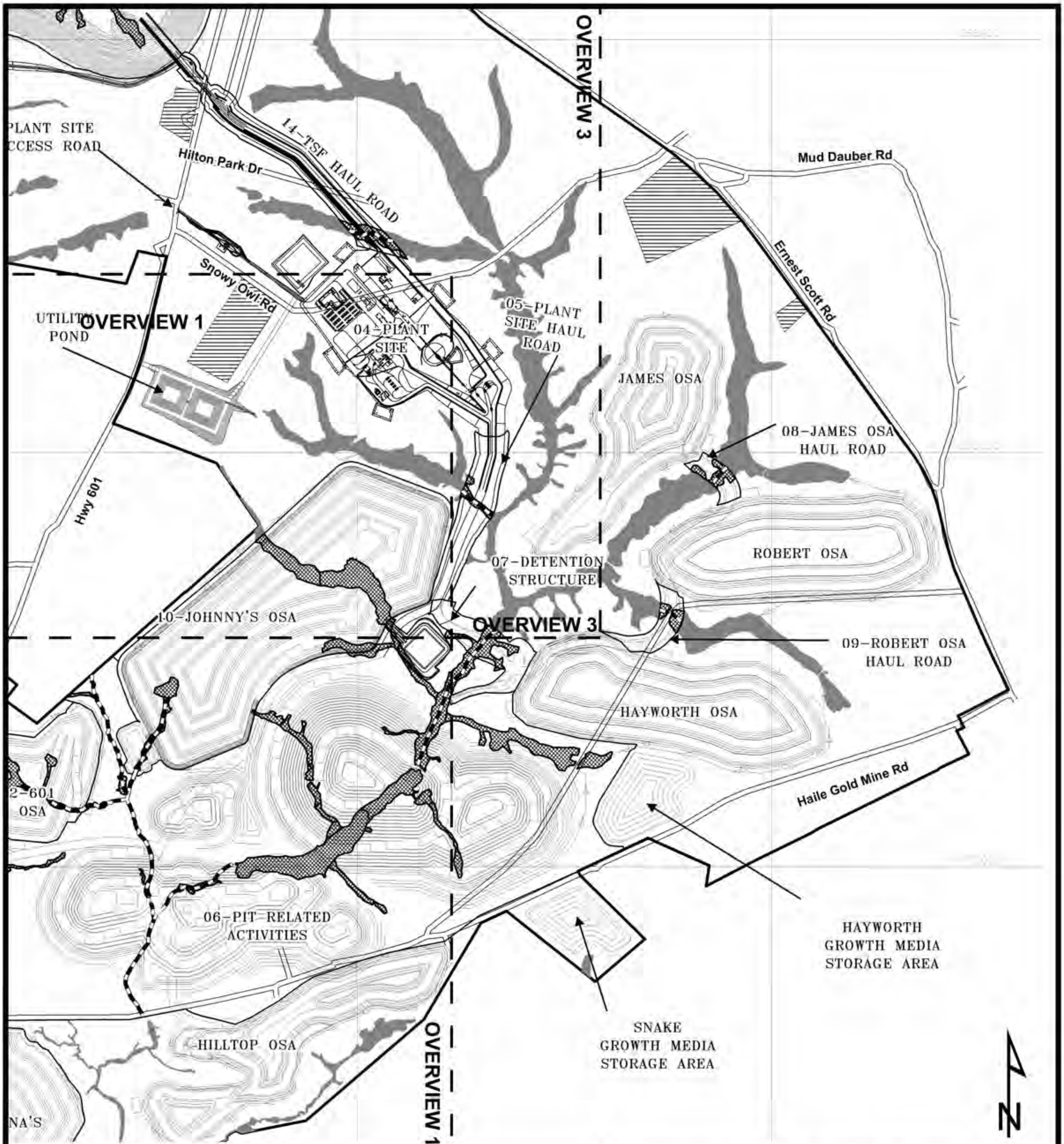
Legend

- Property Boundary
- Stream Impact
- Wetland Impact
- Exclusion Area
- Wetland/Stream
- Overview Sheet Match Line

0 800 1,600 Feet

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SHEET OVERVIEW 2

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

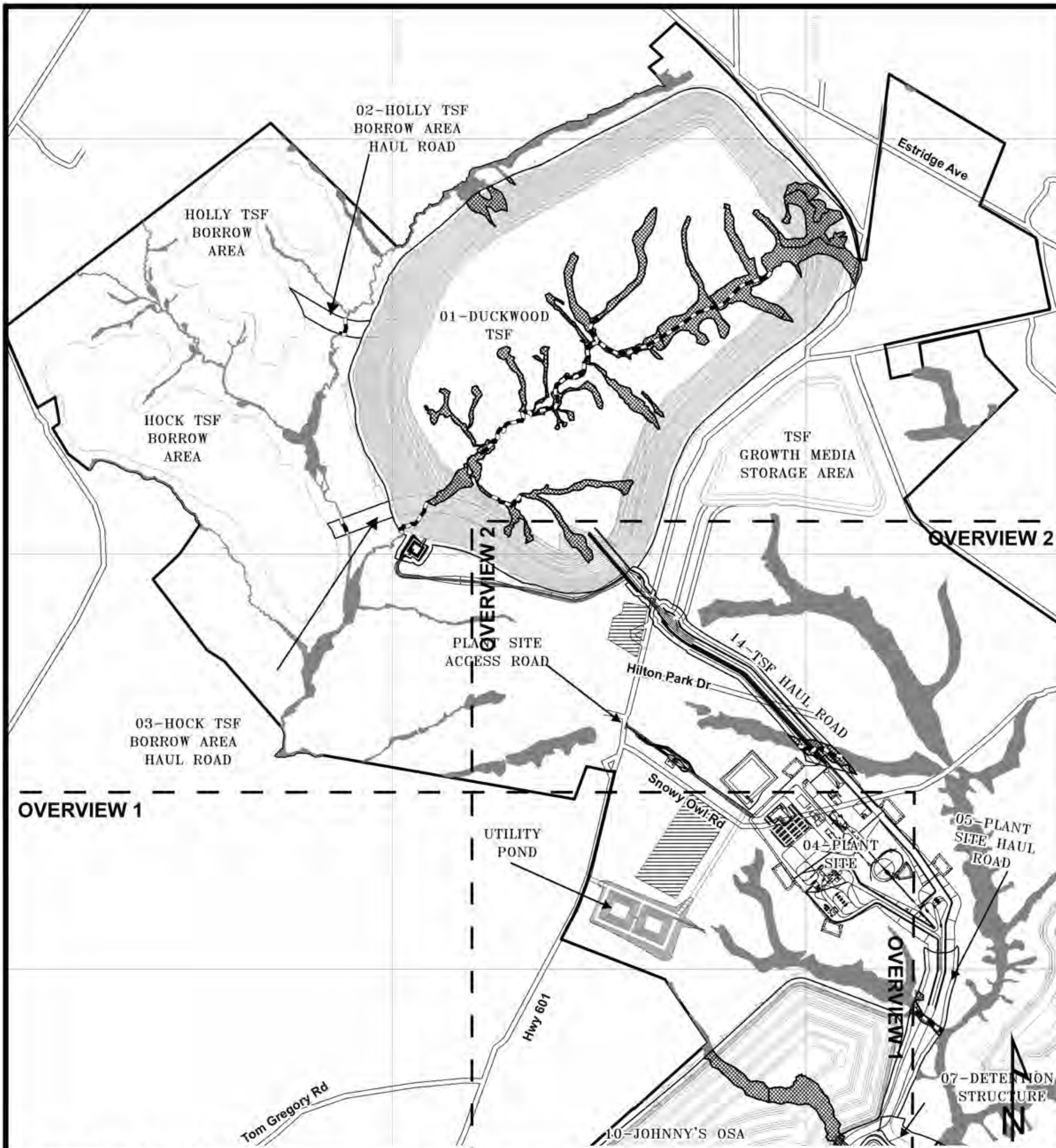
Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

Legend
- **Property Boundary**
- **Exclusion Area**
- **Overview Sheet Match Line** (1)
- **Stream Impact**
- **Wetland/Stream**
- **Wetland Impact**

0 800 1,600 Feet

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SHEET OVERVIEW 3

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

Legend

- Property Boundary
- Exclusion Area
- 1 Overview Sheet Match Line
- Stream Impact
- Wetland/Stream
- Wetland Impact

0 800 1,600 Feet

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

HAILE GOLD MINE INCORPORATED HGM

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067

TABLE 1. AQUATIC RESOURCE DIRECT IMPACT SUMMARY.							
Impact Area	Impact ID	Total Impact (Acres)	Aquatic Resource		[1]Cowardin Classification	Stream Order	Total Impact (Linear Feet)
	AAA1	-	AAA	Reach AAA	R4SB4C	2nd Order	571.29
	AAA2	1.91		Wetland AAA	PSS1/POWHb		
	AAA3	1.05		Wetland AAA	PEM1/POWHb		
	AAA4	0.44		Wetland AAA	PFO1C		
		-		Reach AAA	R4SB4C	2nd Order	167.89
	AAA5	2.06		Wetland AAA	PFO1B		
	AAA6	-		Reach AAA	R4SB4C	2nd Order	707.91
	AAA7	4.91		Wetland AAA	PFO1B		
	AAA7	-		Reach AAA	R4SB4C	2nd Order	1,548.69
	AAA8	1.26		Wetland AAA	PFO1B		
	AAA9	0.28		Wetland AAA	PFO1B		
	AAA10	0.96		Wetland AAA	PFO1C		
	AAA11	0.77		Wetland AAA	PFO1C		
	BBB1	4.2	BBB	Wetland BBB	PFO1B		
		1.25		Wetland BBB	PFO1C		
		-		Reach BBB	R4SB4C	1st Order	450.67
	DDD1	2.34	DDD	Wetland DDD	PFO1B		
		3.41		Wetland DDD	PFO1C		
		-		Reach DDD	R4SB4C	1st Order	348.52
	EEE1	0.17	EEE	Wetland EEE	PEM1C		
		1.86		Wetland EEE	PFO1B		
		20.32		Wetland EEE	PFO1C		
		5.28		Wetland EEE	PSS1C		
		-		Reach EEE	R4SB4C	1st Order	2,419.18
	QQQ1	2.28	QQQ	Wetland QQQ	PFO1B		
01-DUCKWOOD TSF					TOTAL WETLAND IMPACT (acres) =	54.75	
					TOTAL STREAM IMPACT (linear feet) =	6,214.15	
	OOO1	-	OOO	Reach OOO	R4SB4C	2nd Order	277.96
02-HOLLY TSF BORROW AREA HAUL ROAD					TOTAL WETLAND IMPACT (acres) =	0	
					TOTAL STREAM IMPACT (linear feet) =	277.96	
	SS1	-	SS	Reach SS	R4SB4C	3rd Order	203.58
03-HOCK TSF BORROW AREA HAUL ROAD					TOTAL WETLAND IMPACT (acres) =	0	
					TOTAL STREAM IMPACT (linear feet) =	203.58	
	-	-	-				
04-PLANT SITE					TOTAL WETLAND IMPACT (acres) =	0	
					TOTAL STREAM IMPACT (linear feet) =	0	

SHEET TABLE 1 (PAGE 1 OF 4)

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067

TABLE 1. AQUATIC RESOURCE DIRECT IMPACT SUMMARY.							
Impact Area	Impact ID	Total Impact (Acres)	Aquatic Resource		[1]Cowardin Classification	Stream Order	Total Impact (Linear Feet)
	S1	1.02	S	Wetland S	PFO1B		
		-		Reach S	R4SB4C	1st Order	471.51
	R1	0	R	Wetland R	PFO1B		
05-PLANT SITE HAUL ROAD				TOTAL WETLAND IMPACT (acres) =		1.02	
				TOTAL STREAM IMPACT (linear feet) =		471.51	
	D2	0.51	D	Wetland D	PFO1C		
	F1	-	F	Reach F	R2UB2H	3rd Order	1,361.85
	F2	0.76		Wetland F	PFO1B		
		-		Reach F	R2UB2H	3rd Order	1,090.46
	F3	9.51		Reach F	[2] POWHh		
	F4	1.07		Wetland F	PFO1B		
	F5	0.42		Wetland F	PSS1Hh		
	F6	0.48		Wetland F	PEM1C		
		0.36		Wetland F	PSS1C		
	F7	3.13		Wetland F	PEM1Hh		
		0.08		Wetland F	PFO1Hh		
	F8	0.61		Wetland F	PEM1H		
		1.06		Wetland F	PFO1B		
	F9	5.39		Wetland F	PFO1B		
		-		Reach F	R2UB2H	3rd Order	1,506.23
	F10	0.74		Wetland F	PFO1B		
		0.96		Wetland F	PFO1C		
	F11	6.48		Wetland F	PFO1B		
	F12	0.05		Wetland F	PFO1C		
	F18	0.28		Wetland F	PEM1C		
		0.6		Wetland F	PFO1C		
		1.21		Wetland F	PSS1C		
	J1	0.33	J	Wetland J	PFO1C		
		0.28		Wetland J	PSS1C		
		-		Reach J	R4SB4C	2nd Order	1,564.74
	J2	0.95		Wetland J	PFO1C		
	L1	0.31	L	Wetland L	PFO1C		
		-		Reach L	R4SB4C	1st Order	547.29
	M1	0.65	M	Wetland M	PFO1C		
		-		Reach M	R4SB4C	1st Order	1,608.36
	N1	0.16	N	Wetland N	PFO1C		
		-		Reach N	R4SB4C	1st Order	241.59
06-PIT RELATED ACTIVITIES				TOTAL WETLAND IMPACT (acres) =		36.38	
				TOTAL STREAM IMPACT (linear feet) =		7,920.52	

SHEET TABLE 1 (PAGE 2 OF 4) - Revised November 2012

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067

TABLE 1. AQUATIC RESOURCE DIRECT IMPACT SUMMARY.							
Impact Area	**Impact ID**	**Total Impact (Acres)**	**Aquatic Resource**		**[1]Cowardin Classification**	**Stream Order**	**Total Impact (Linear Feet)**
	F17	2.77	F	Wetland F	PFO1B		
		-		Reach F	R2UB2H	3rd Order	427.13
07-DETENTION STRUCTURE				TOTAL WETLAND IMPACT (acres) =		2.77	
				TOTAL STREAM IMPACT (linear feet) =		427.13	
	Q1	1.45	Q	Wetland Q	PFO1B		
		-		Reach Q	R4SB4C	1st Order	269.17
08-JAMES OSA HAUL ROAD				TOTAL WETLAND IMPACT (acres) =		1.45	
				TOTAL STREAM IMPACT (linear feet) =		269.17	
	P1	1.13	P	Wetland P	PFO1B		
		-		Reach P	R4SB4C	1st Order	261.01
09-ROBERT OSA HAUL ROAD				TOTAL WETLAND IMPACT (acres) =		1.13	
				TOTAL STREAM IMPACT (linear feet) =		261.01	
	F13	0.03	F	Wetland F	PFO1C		
	F14	1.38		Wetland F	PFO1B		
	F15	0.54		Wetland F	PFO1C		
	F16	3.09		Wetland F	PFO1B		
		5.66		Wetland F	PFO1C		
	N2	1.27	N	Wetland N	PFO1C		
		1.03		Wetland N	PFO1B		
		-		Reach N	R4SB4C	1st Order	1,011.80
10-JOHNNY'S OSA				TOTAL WETLAND IMPACT (acres) =		13.00	
				TOTAL STREAM IMPACT (linear feet) =		1,011.80	
	C1	0.07	C	Wetland C	PFO1B		
		-		Reach C	R4SB4C	1st Order	1,576.84
	D1	0.4	D	Wetland D	PFO1C		
		-		Reach D	R4SB4C	1st Order	3,532.55
	E1	0.27	E	Wetland E	PFO1C		
		1.48		Reach E	[2]POWHh		
		-		Reach E	R4SB4C	1st Order	2,001.83
11-RAMONA'S OSA				TOTAL WETLAND IMPACT (acres) =		2.22	
				TOTAL STREAM IMPACT (linear feet) =		7,111.22	
	L2	3.27	L	Wetland L	PFO1C		
		-		Reach L	R4SB4C	1st Order	877.40
12-601 OSA				TOTAL WETLAND IMPACT (acres) =		3.27	
				TOTAL STREAM IMPACT (linear feet) =		877.40	

SHEET TABLE 1 (PAGE 3 OF 4) - **Revised November 2012**

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067

TABLE 1. AQUATIC RESOURCE DIRECT IMPACT SUMMARY.

Impact Area	Impact ID	Total Impact (Acres)	Aquatic Resource		[1]Cowardin Classification	Stream Order	Total Impact (Linear Feet)
	BB1	0.34	BB	Wetland BB	PSS1C		
	CC1	0.33	CC	Wetland CC	PFO1B		
		0.51		Wetland CC	PFO1C		
		0.09		Wetland CC	PFO1H		
		-		Reach CC	R4SB4C	1st Order	320.71
	EE1	0.12	EE	Wetland EE	PSS1C		
	HH1	0.25	HH	Wetland HH	PFO1C		
	JJ1	0.42	JJ	Wetland JJ	PSS1C		
		-		Reach JJ	R4SB4C	1st Order	260.48
	KK1	0.17	KK	Wetland KK	PSS1C		
		-		Reach KK	R4SB4C	1st Order	219.26
13-CHAMPION PIT					TOTAL WETLAND IMPACT (acres) =	2.23	
					TOTAL STREAM IMPACT (linear feet) =	800.45	
	T1	1.13	T	NA	PFO1B*		
	T2	1.11		Wetland T	PFO1B		
		0		Reach T	R4SB4C	1st Order	614.64
14-TSF HAUL ROAD					TOTAL WETLAND IMPACT (acres) =	2.24	
					TOTAL STREAM IMPACT (linear feet) =	614.64	
TOTAL WATERS OF THE US DIRECT IMPACT DIRECT IMPACT:							
					TOTAL WETLAND IMPACT (acres) =	**120.46**	
					Subtotal Wetland =	***109.47***	
					Subtotal Reservoir/Open Water =	***10.99***	
					TOTAL STREAM IMPACT (linear feet) =	**26,460.54**	

Notes:

[1] Cowardin Classification based on: Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et. al 1979). Refer to the Jurisdictional Determination Request Wetland Delineation Report (REVISED – August 2012) for a detailed description of wetland habitat types.

[2] Cowardin Classification POWHh designates reservoir/open water habitat type.

* = Approximate wetland area.

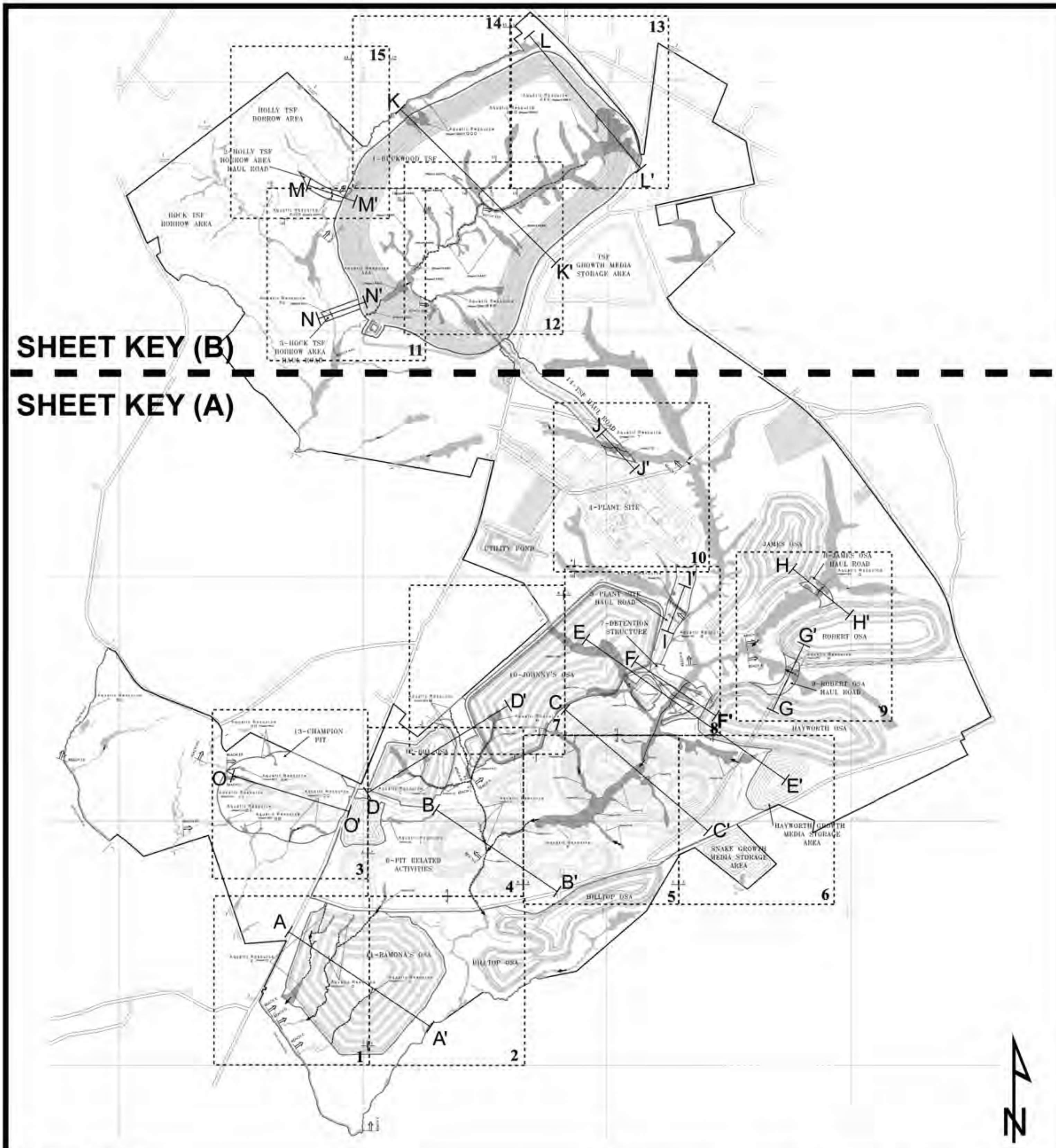
SHEET TABLE 1 (PAGE 4 OF 4)

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SHEET KEY

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC	Date: August 15, 2012	Note: Refer to 2012 Revised Permit Application.

Legend

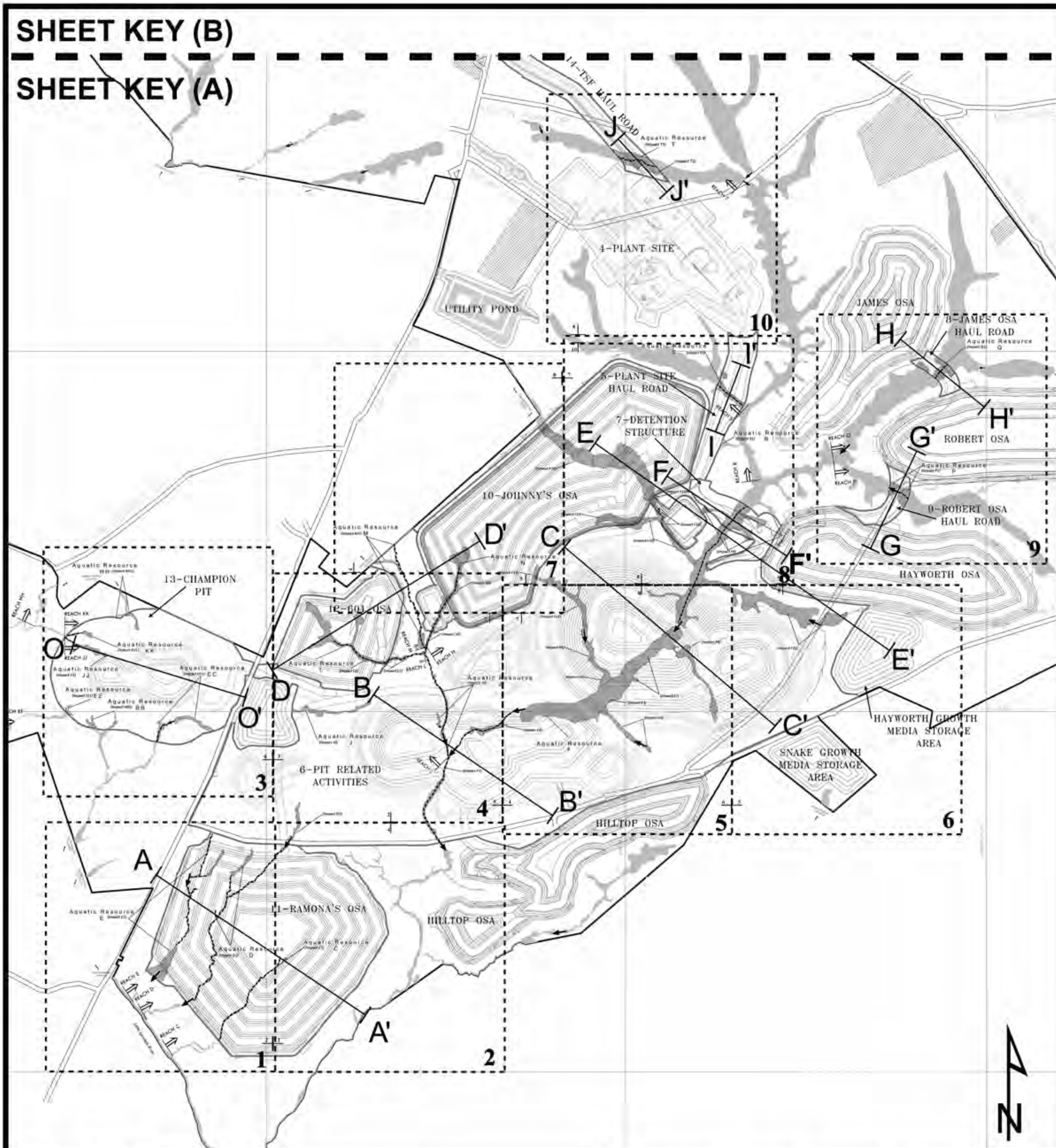
- Property Boundary
- Stream Impact
- Wetland Impact
- Exclusion Area
- Wetland/Stream
- Existing Culvert
- 13 Sheet Match Line
- 1 Sheet Key
- Schematic Cross-Section

0 1,500 3,000 Feet

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

HAILE GOLD MINE HGM INCORPORATED

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SHEET KEY (A)

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

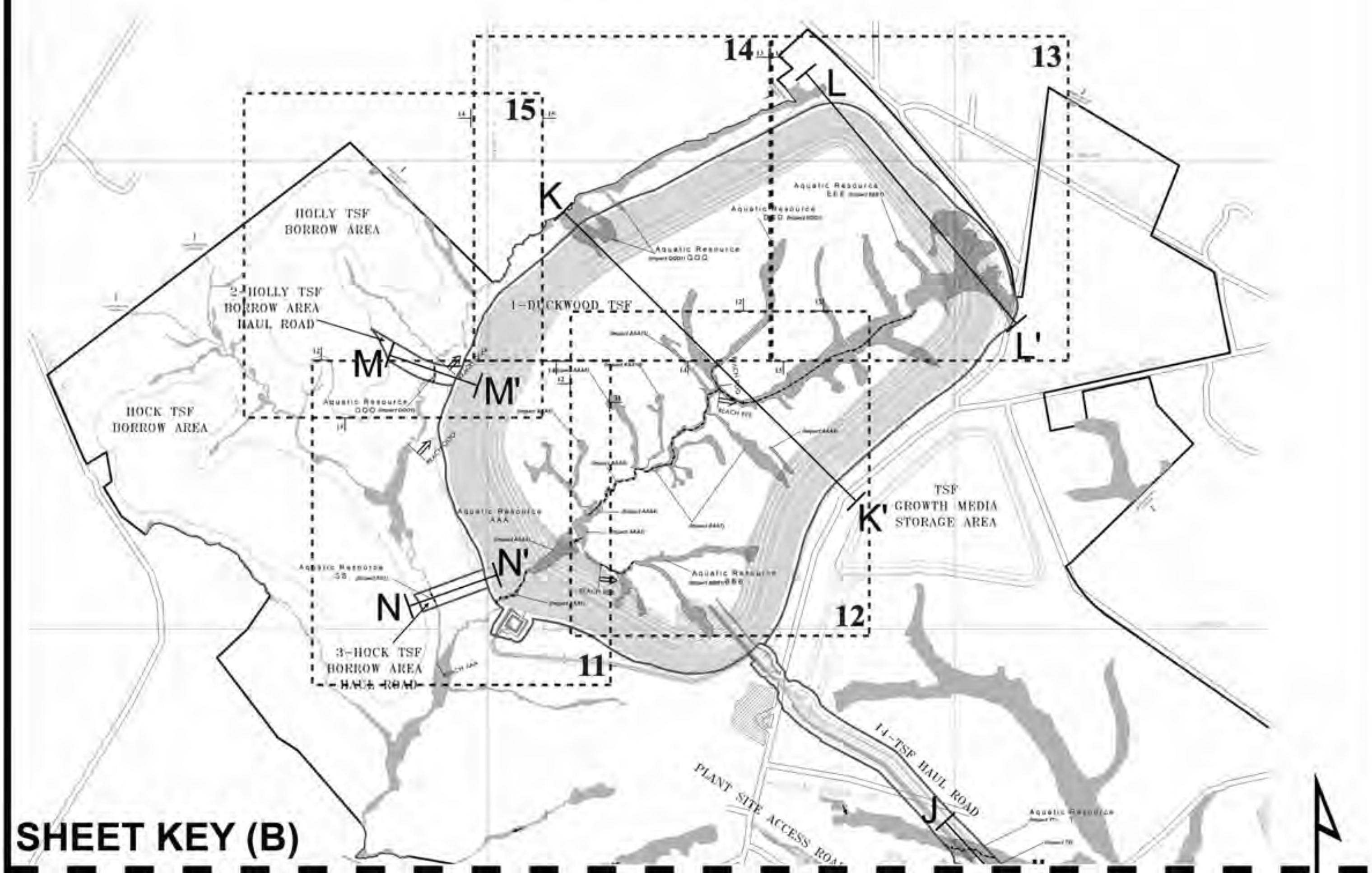
Legend

- Property Boundary
- Stream Impact
- Wetland Impact
- Exclusion Area
- Wetland/Stream
- Existing Culvert
- 13 Sheet Match Line
- 1 Sheet Key
- Schematic Cross-Section

0 — 1,500 — 3,000 Feet

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SHEET KEY (B)

SHEET KEY (A)

SHEET KEY (B)

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC	Date: August 15, 2012	*Note: Refer to 2012 Revised Permit Application.*

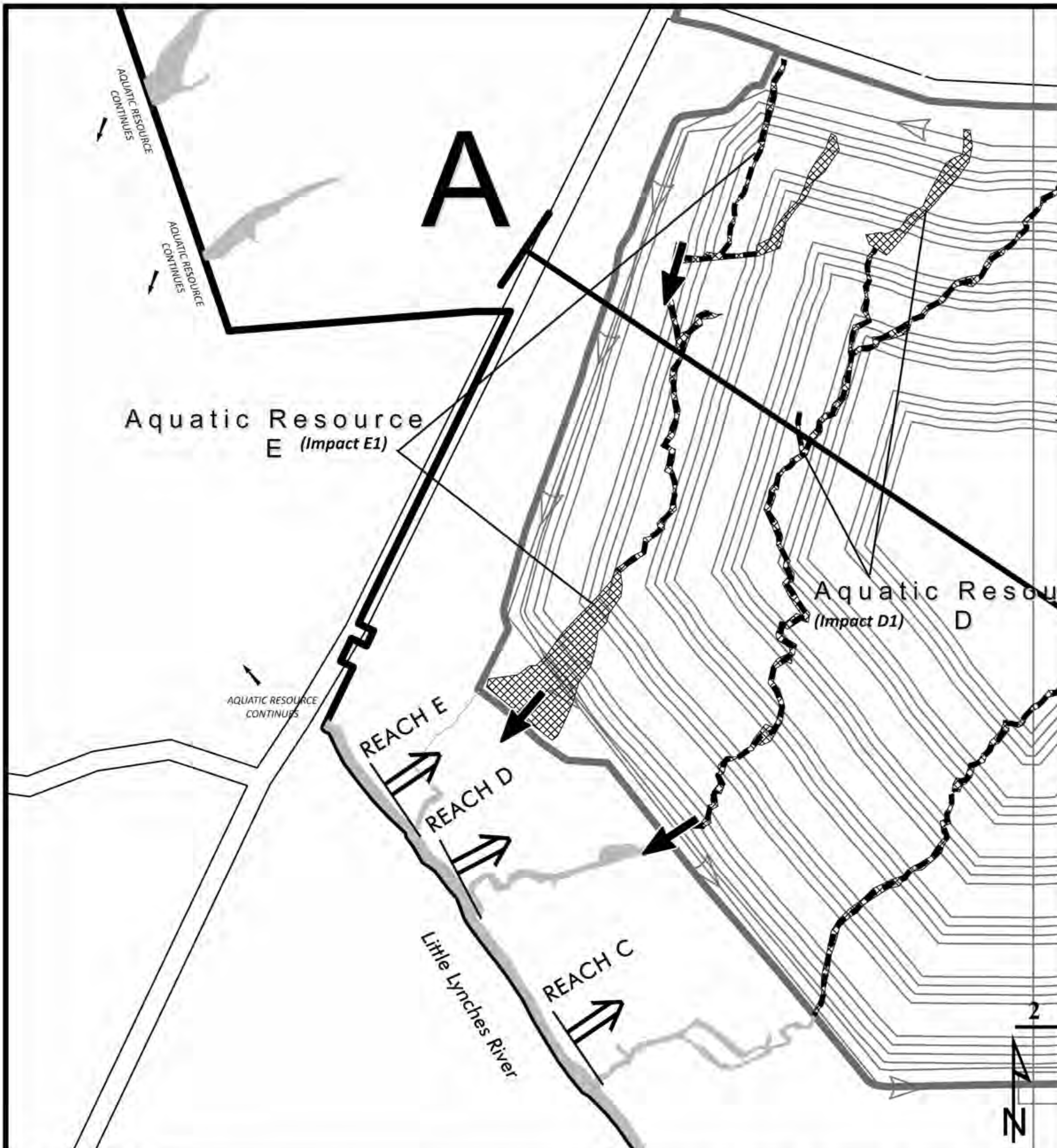
Legend

- Property Boundary
- Stream Impact
- Wetland Impact
- Exclusion Area
- Wetland/Stream
- Existing Culvert
- 13 Sheet Match Line
- 1 Sheet Key
- Schematic Cross-Section

0 1,500 3,000 Feet

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SHEET 1 of 30

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

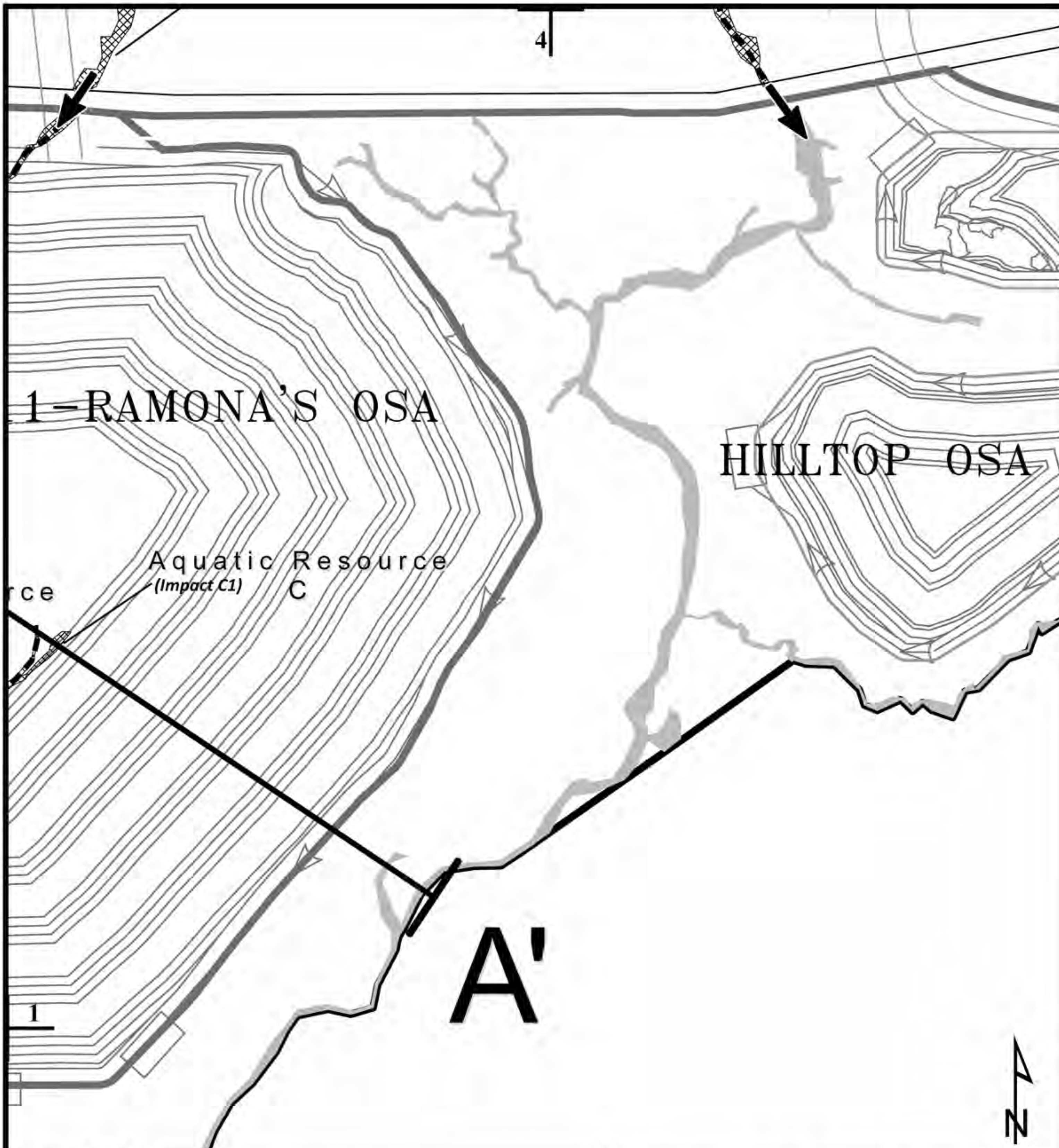
Legend

- **Property Boundary**
- **Stream Impact**
- **Wetland Impact**
- **Exclusion Area**
- **Wetland/Stream**
- **Existing Culvert**
- 13 **Sheet Match Line**
- **Stream Reach ID**
- **Schematic Cross-Section**

0 200 400 Feet

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SHEET 2 of 30

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

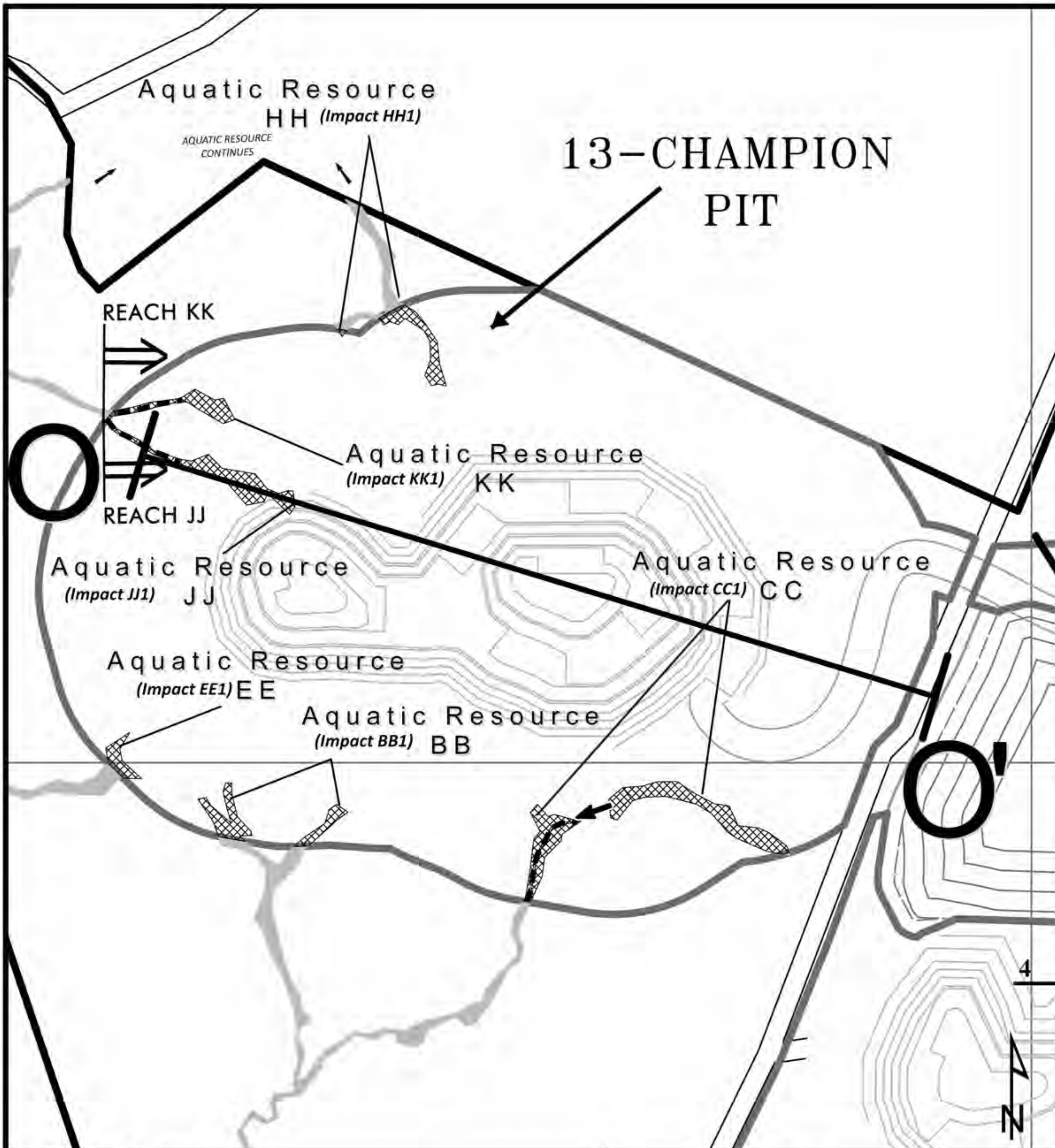
Legend

- Property Boundary
- Stream Impact
- Wetland Impact
- Exclusion Area
- Wetland/Stream
- Existing Culvert
- 13 Sheet Match Line
- Stream Reach ID
- Schematic Cross-Section

0 200 400 Feet

HAILE GOLD MINE PROJECT
(SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SHEET 3 of 30

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC | Date: August 15, 2012

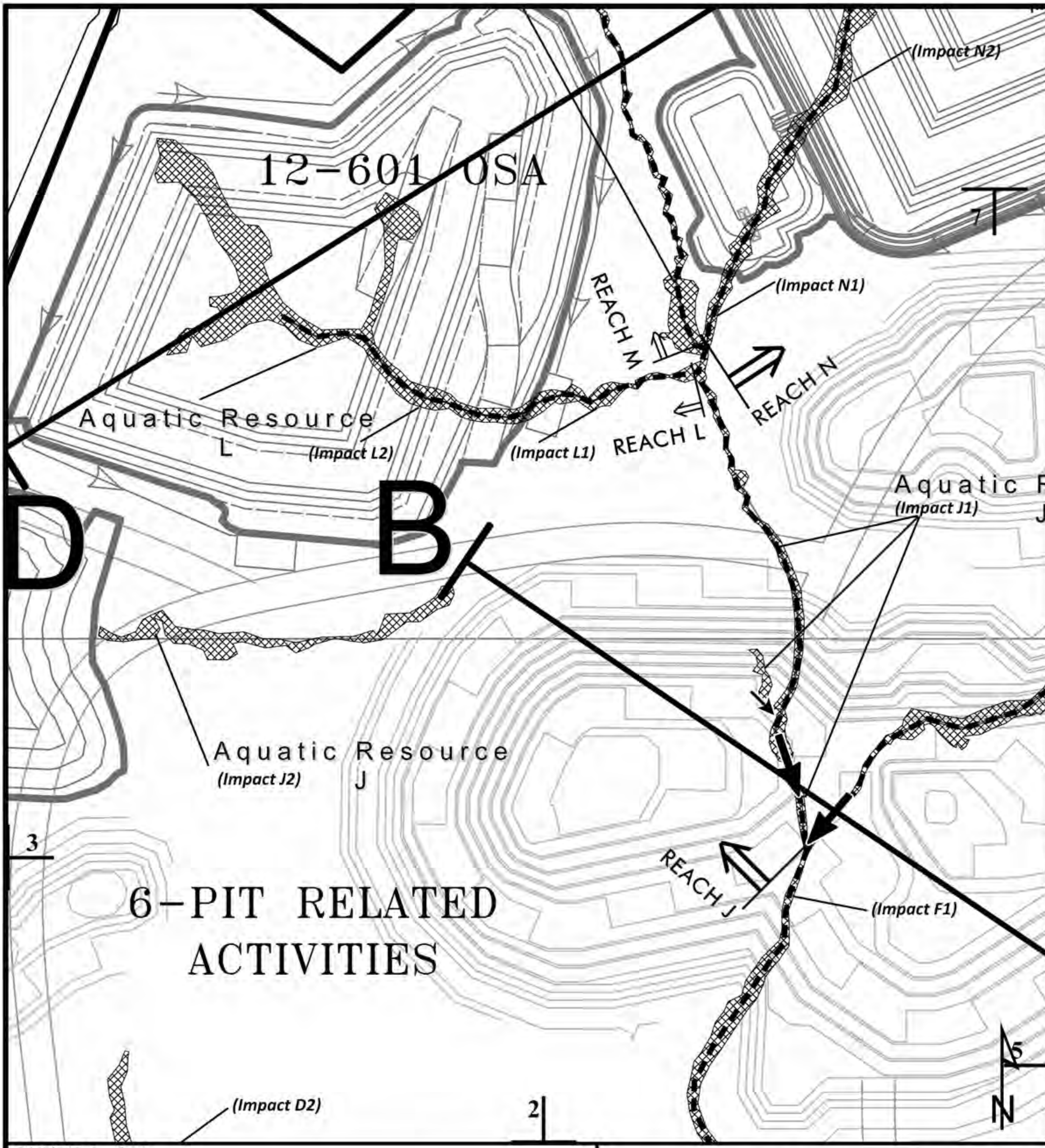
Note: Refer to 2012 Revised Permit Application.

Legend
- Property Boundary
- Stream Impact
- Wetland Impact
- Exclusion Area
- Wetland/Stream
- Existing Culvert
- 13 Sheet Match Line
- Stream Reach ID
- Schematic Cross-Section
- 0 200 400 Feet

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

HAILE GOLD MINE HGM INCORPORATED

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SHEET 4 of 30

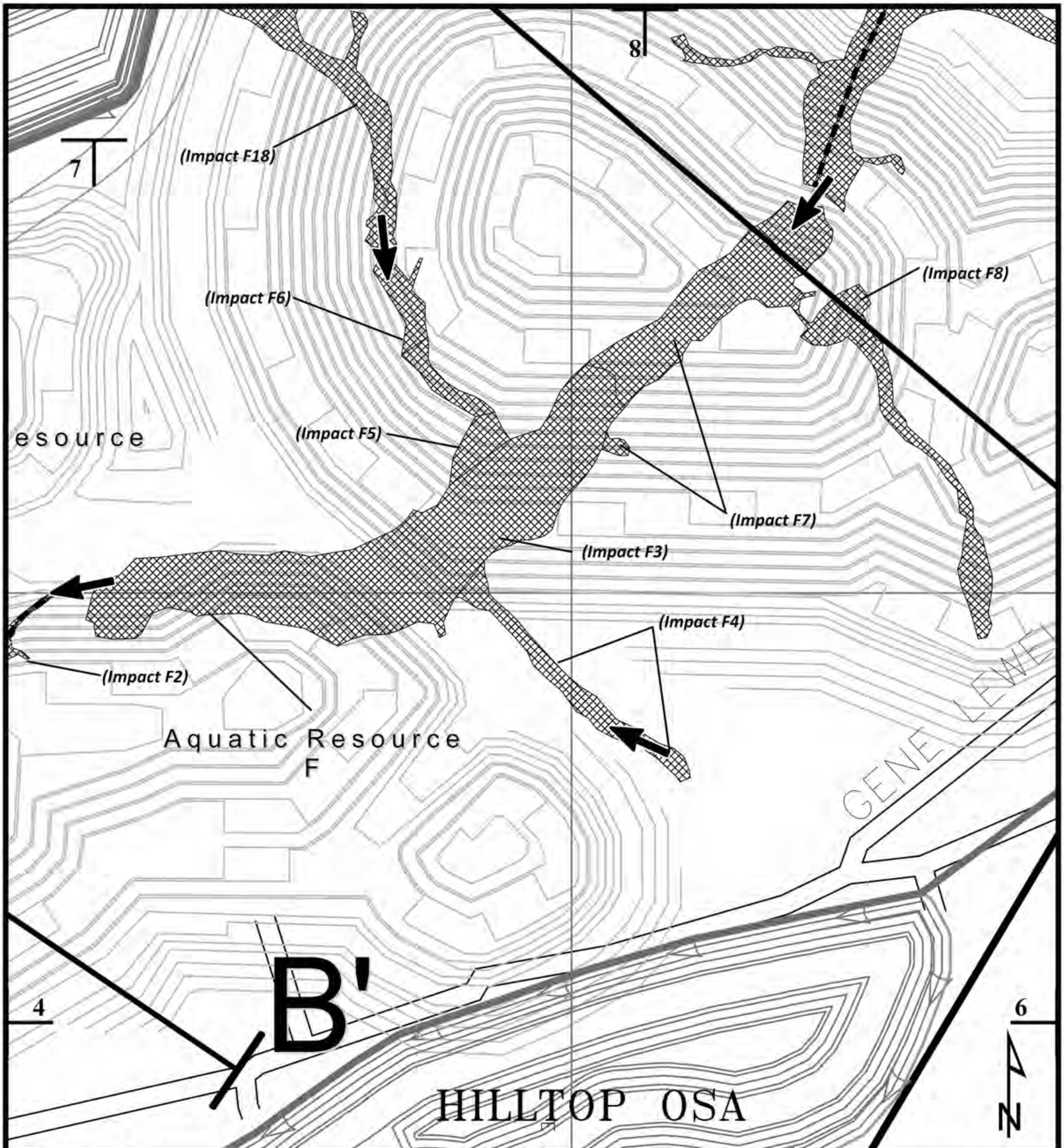
Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

Legend
- Property Boundary
- Stream Impact
- Wetland Impact
- Exclusion Area
- Wetland/Stream
- Existing Culvert
- 13 Sheet Match Line
- Stream Reach ID
- Schematic Cross-Section
- 0 200 400 Feet

HAILE GOLD MINE PROJECT
(SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SHEET 5 of 30

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC	Date: August 15, 2012	*Note: Refer to 2012 Revised Permit Application.*

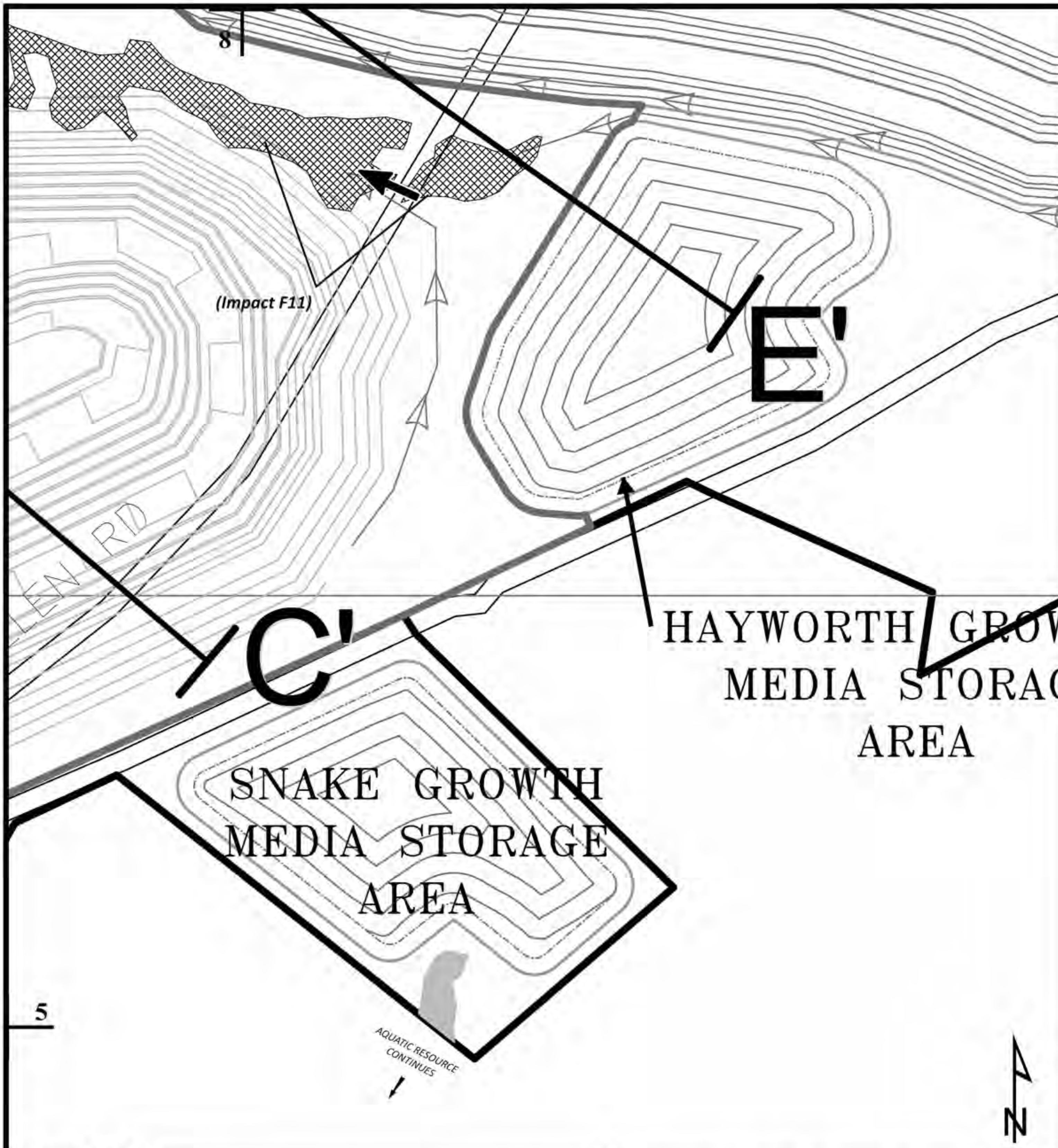
Legend

- **Property Boundary**
- **Stream Impact**
- **Wetland Impact**
- **Exclusion Area**
- **Wetland/Stream**
- **Existing Culvert**
- 13 **Sheet Match Line**
- **Stream Reach ID**
- **Schematic Cross-Section**
- 0 200 400 Feet

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

HAILE GOLD MINE HGM INCORPORATED

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SHEET 6 of 30

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

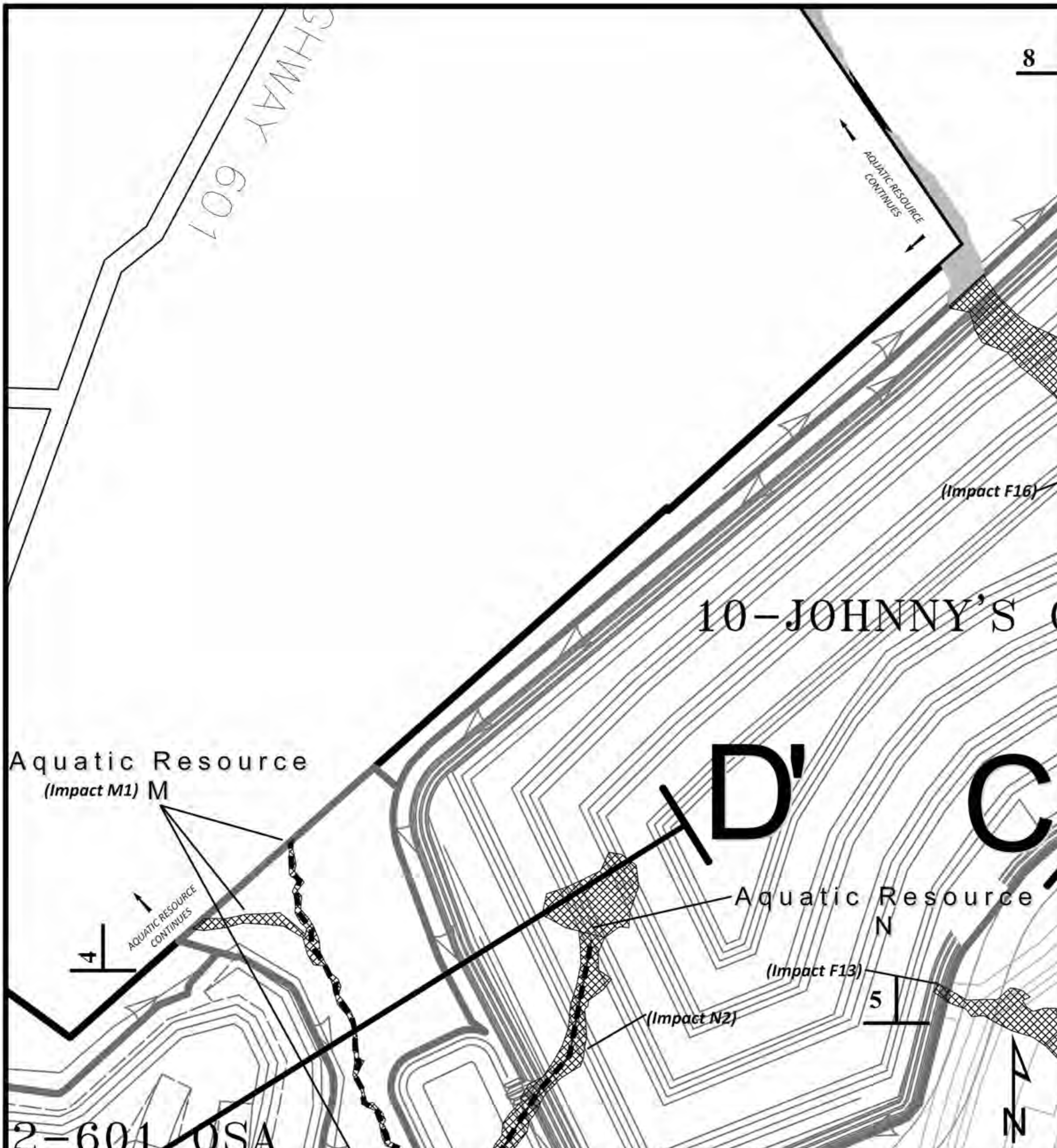
Drawn by: ERC | Date: August 15, 2012 | Note: Refer to 2012 Revised Permit Application.

Legend

- Property Boundary
- Stream Impact
- Wetland Impact
- Exclusion Area
- Wetland/Stream
- Existing Culvert
- 13 Sheet Match Line
- Stream Reach ID
- Schematic Cross-Section
- 0 200 400 Feet

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SHEET 7 of 30

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

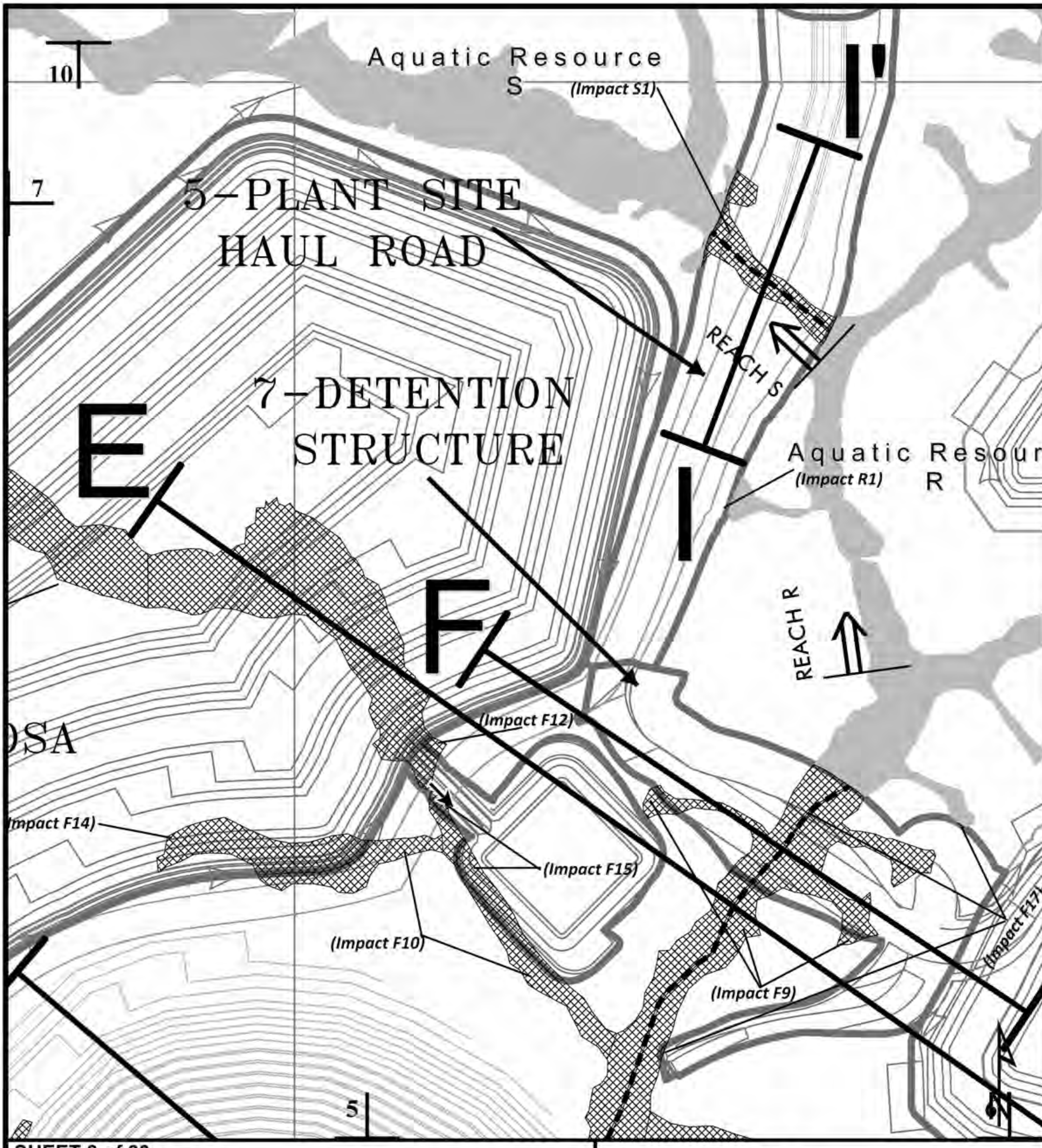
Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

Legend

- **Property Boundary**
- **Stream Impact**
- **Wetland Impact**
- **Exclusion Area**
- **Wetland/Stream**
- **Existing Culvert**
- 13 **Sheet Match Line**
- **Stream Reach ID**
- **Schematic Cross-Section**
- 0 200 400 Feet

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SHEET 8 of 30

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

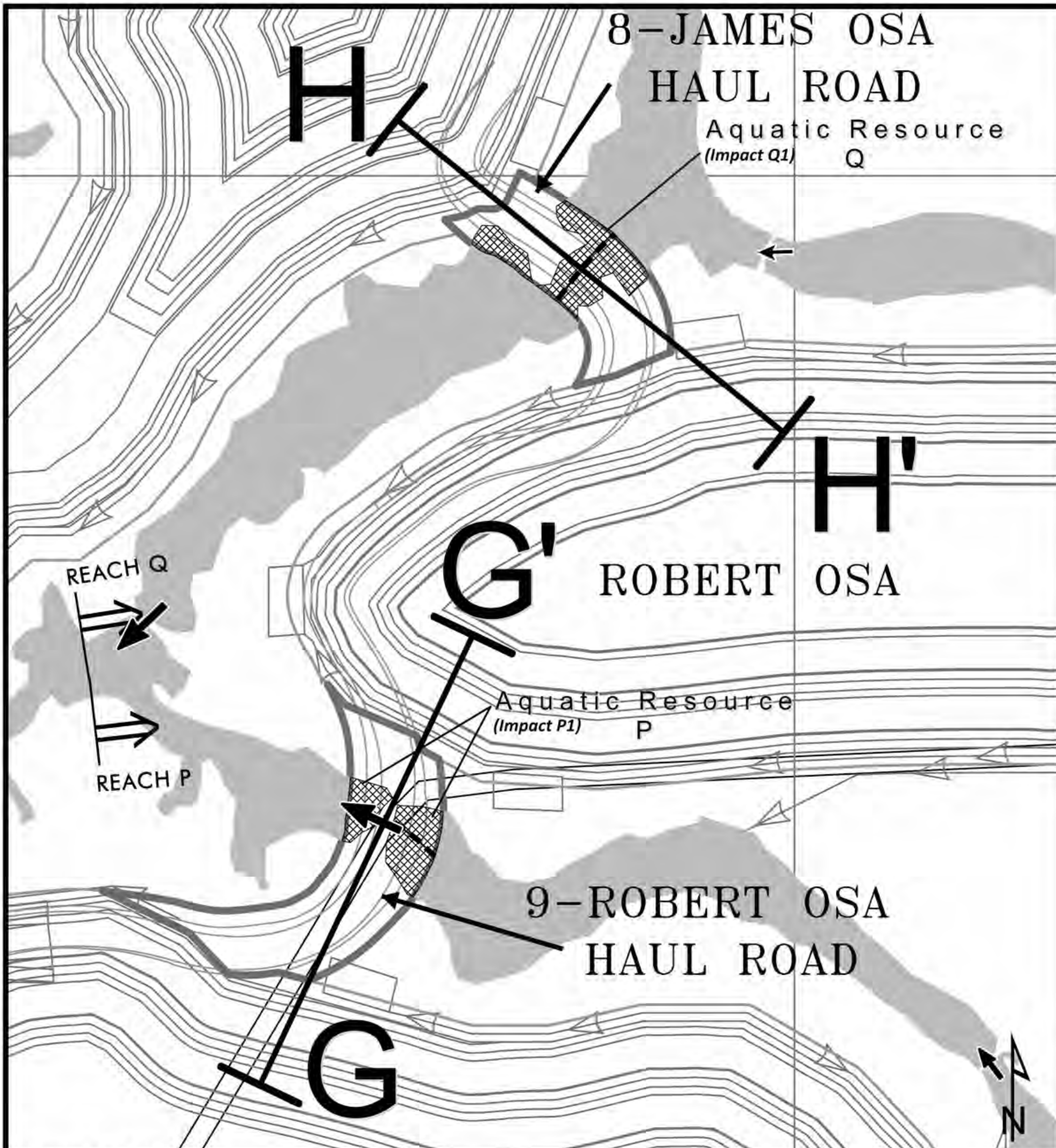
Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

Legend

- **Property Boundary**
- **Stream Impact**
- **Wetland Impact**
- **Exclusion Area**
- **Wetland/Stream**
- **Existing Culvert**
- 13 **Sheet Match Line**
- **Stream Reach ID**
- **Schematic Cross-Section**
- 0 200 400 Feet

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SHEET 9 of 30

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

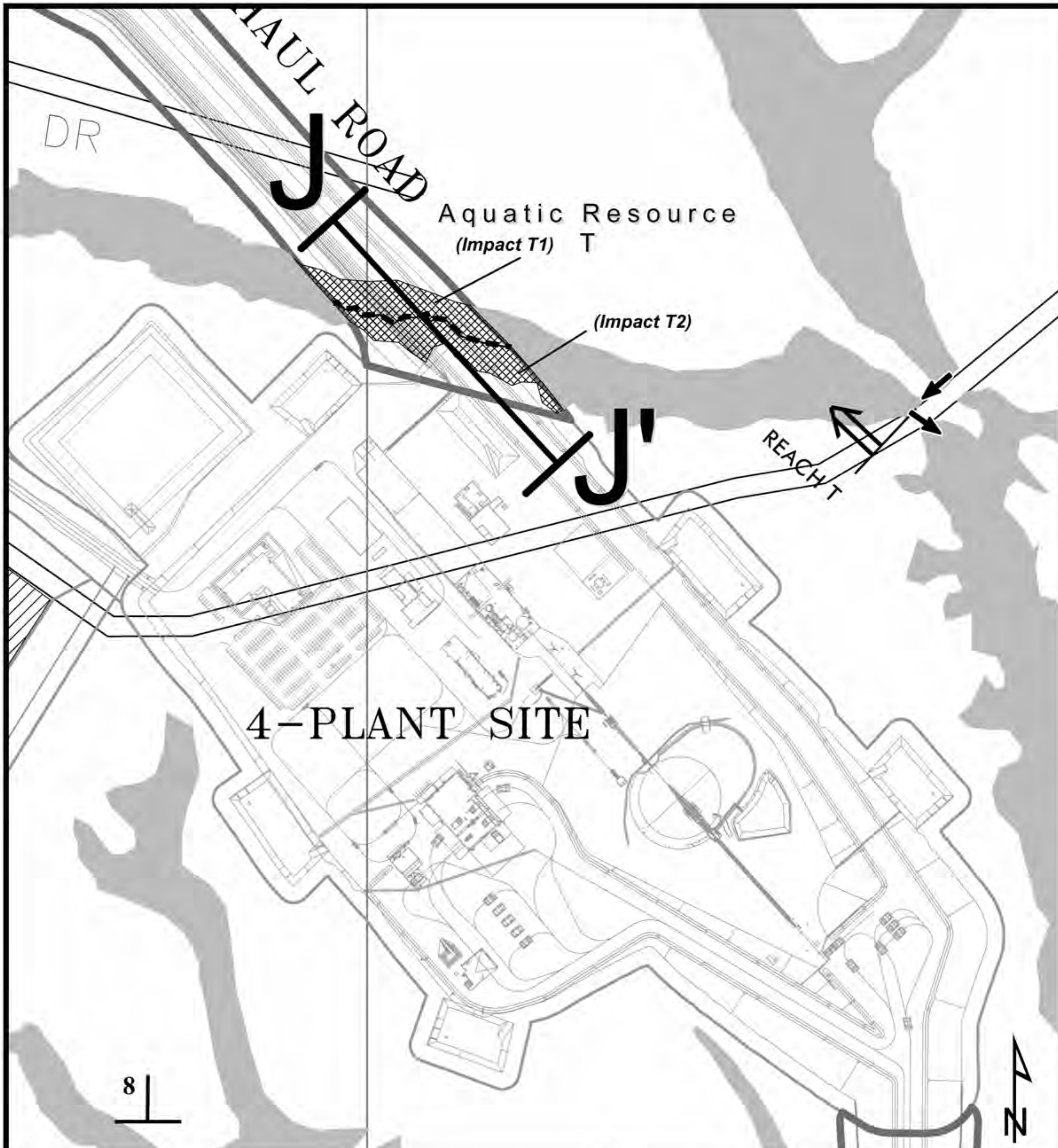
Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

Legend

- **Property Boundary**
- **Stream Impact**
- **Wetland Impact**
- **Exclusion Area**
- **Wetland/Stream**
- **Existing Culvert**
- 13 **Sheet Match Line**
- **Stream Reach ID**
- **Schematic Cross-Section**
- 0 200 400 Feet

HAILE GOLD MINE PROJECT
(SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SHEET 10 of 30

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

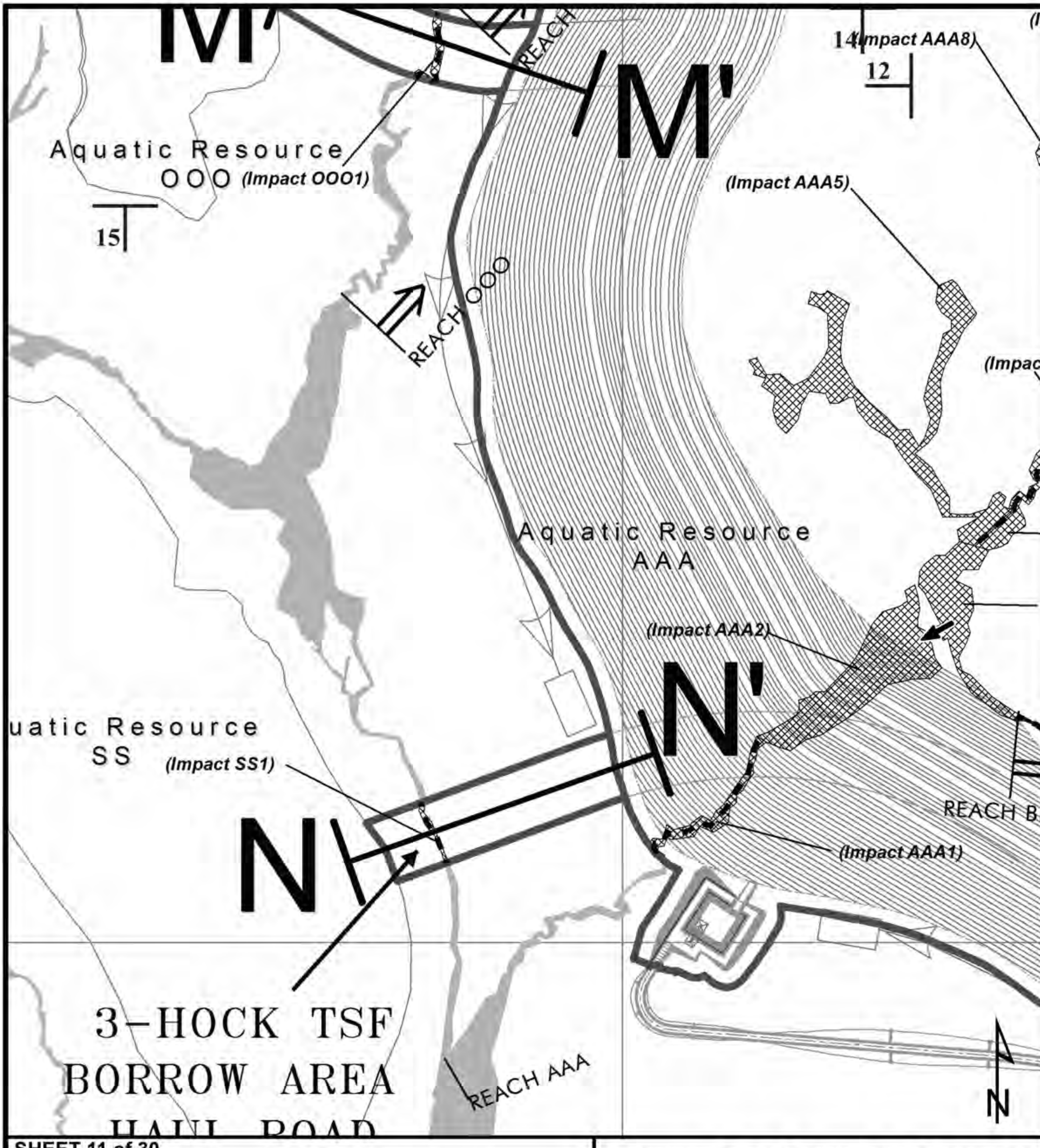
HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Legend
- **Property Boundary**
- **Stream Impact**
- **Wetland Impact**
- **Exclusion Area**
- **Wetland/Stream**
- **Existing Culvert**
- 13 **Sheet Match Line**
- **Stream Reach ID**
- **Schematic Cross-Section**

0 200 400 Feet

HAILE GOLD MINE HGM INCORPORATED

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SHEET 11 of 30

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

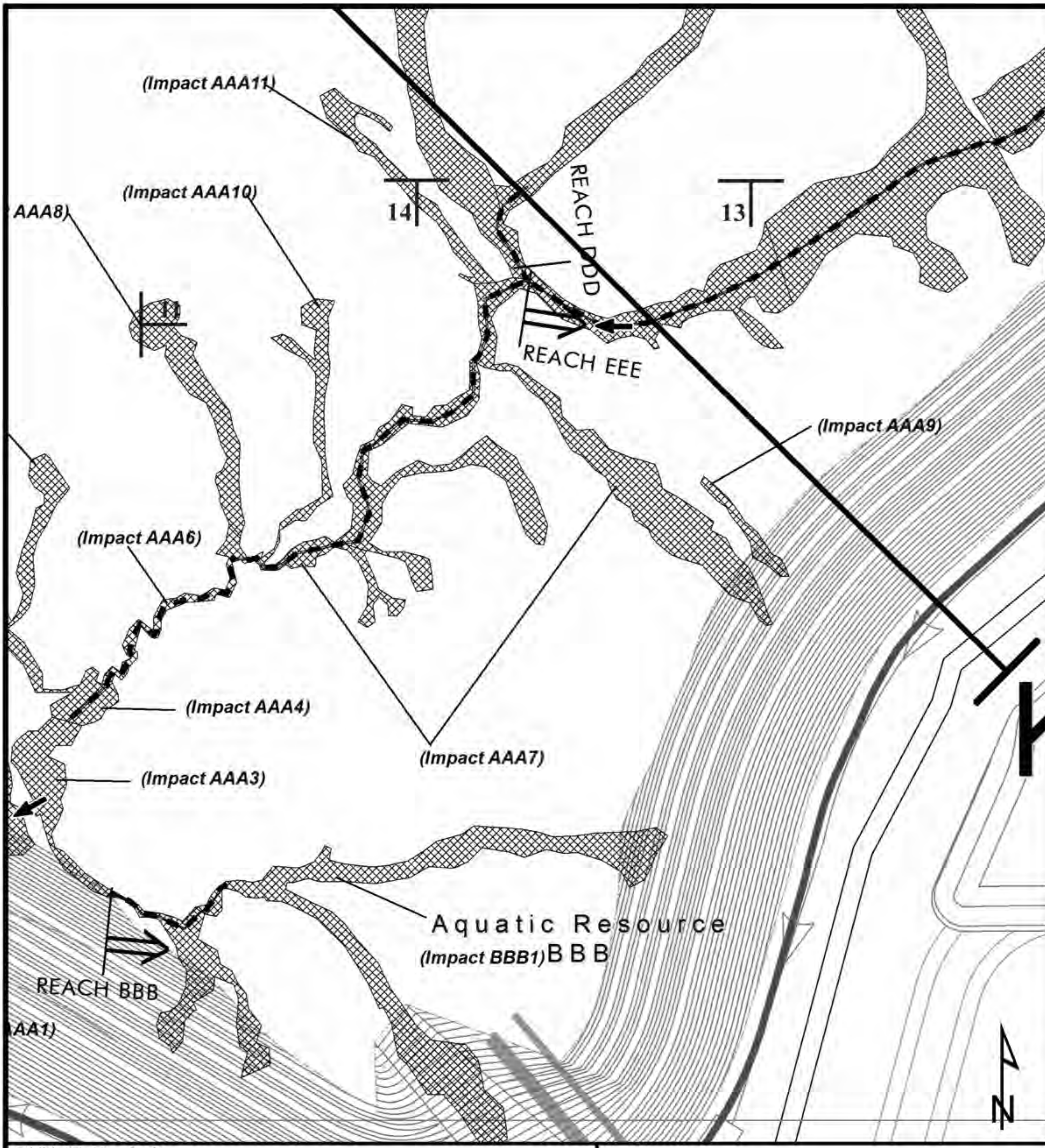
Legend

- Property Boundary
- Stream Impact
- Wetland Impact
- Exclusion Area
- Wetland/Stream
- Existing Culvert
- 13 Sheet Match Line
- Stream Reach ID
- Schematic Cross-Section
- 0 200 400 Feet

HAILE GOLD MINE PROJECT
(SAC 1992-24122-4IA)

HAILE GOLD MINE INCORPORATED

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SHEET 12 of 30

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

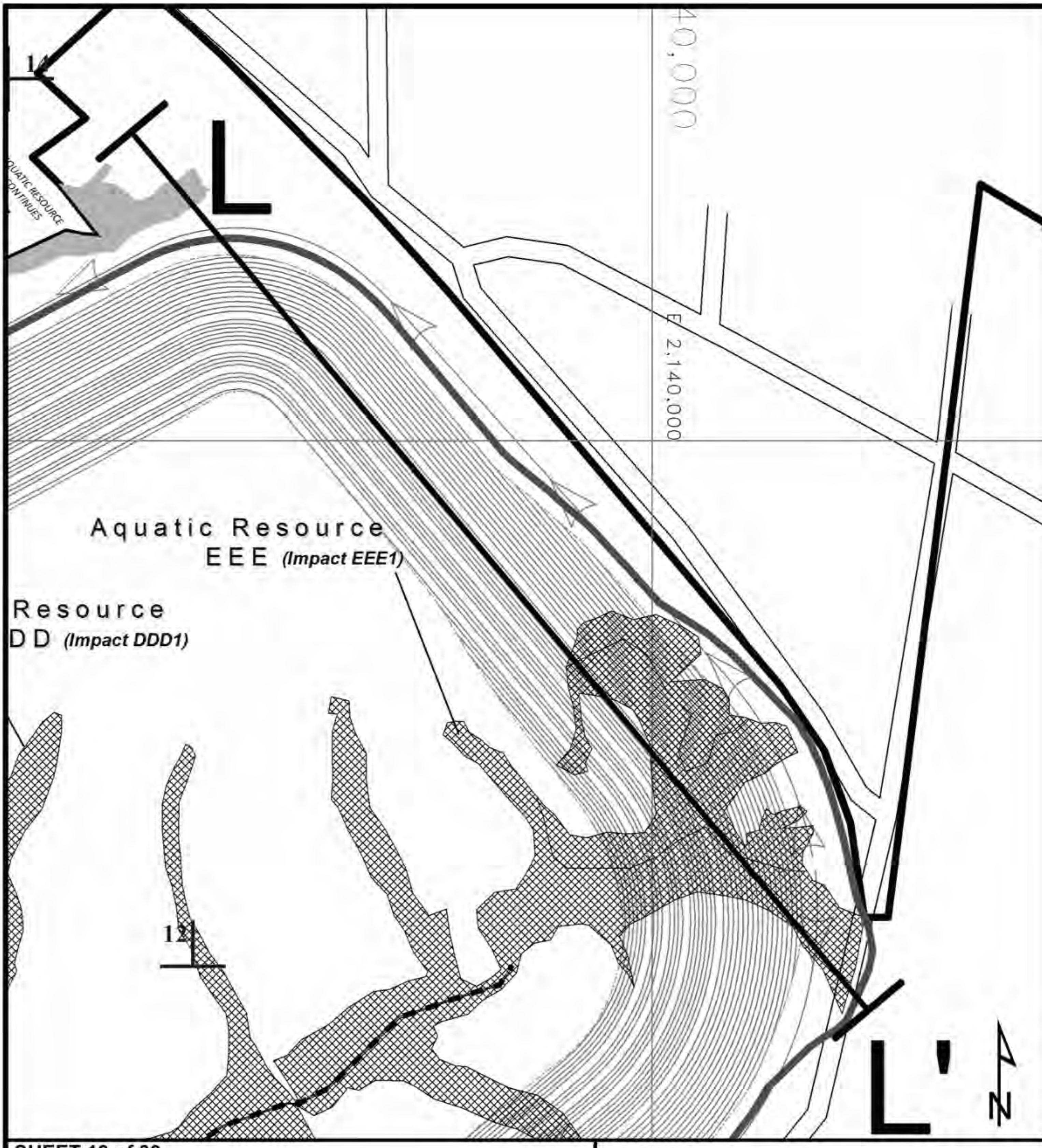
Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

Legend

- **Property Boundary**
- **Stream Impact**
- **Wetland Impact**
- **Exclusion Area**
- **Wetland/Stream**
- **Existing Culvert**
- **Sheet Match Line** (13)
- **Stream Reach ID**
- **Schematic Cross-Section**
- 0 200 400 Feet

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SHEET 13 of 30

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

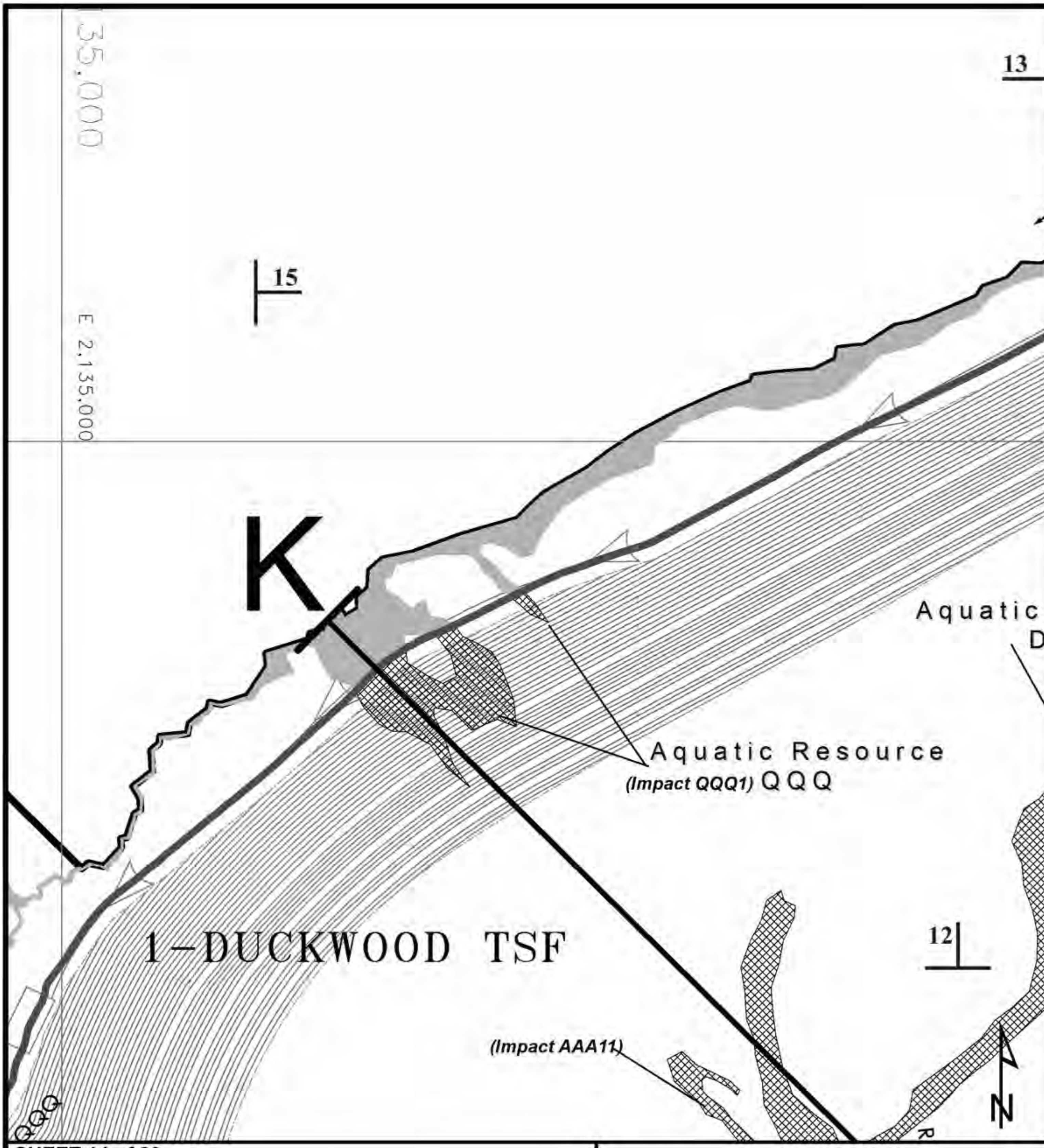
Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

Legend

- **Property Boundary**
- **Stream Impact**
- **Wetland Impact**
- **Exclusion Area**
- **Wetland/Stream**
- **Existing Culvert**
- 13 **Sheet Match Line**
- **Stream Reach ID**
- **Schematic Cross-Section**
- 0 200 400 Feet

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SHEET 14 of 30

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC | Date: August 15, 2012

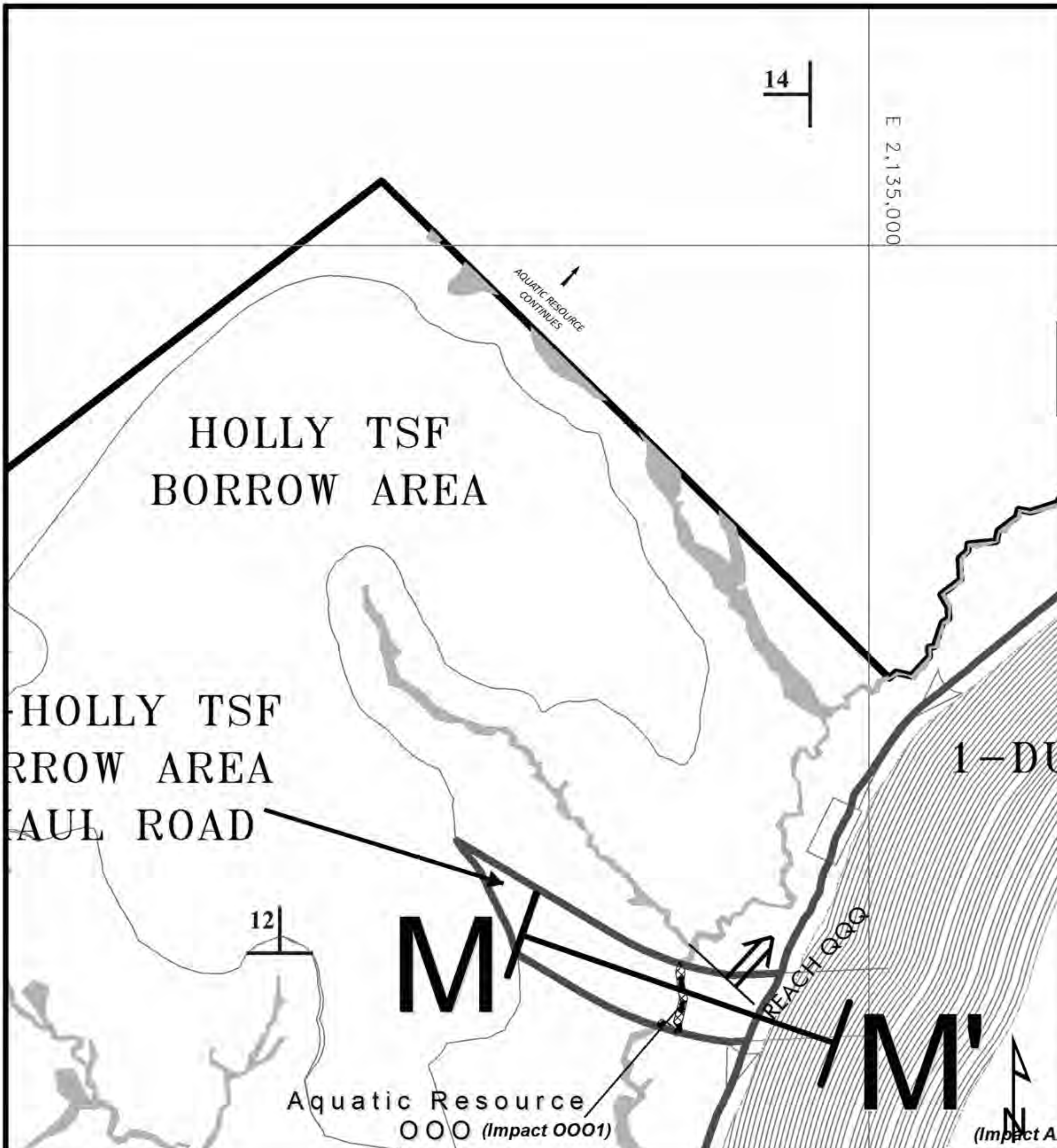
Note: Refer to 2012 Revised Permit Application.

Legend

- Property Boundary
- Stream Impact
- Wetland Impact
- Exclusion Area
- Wetland/Stream
- Existing Culvert
- 13 Sheet Match Line
- Stream Reach ID
- Schematic Cross-Section
- 0 200 400 Feet

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SHEET 15 of 30

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

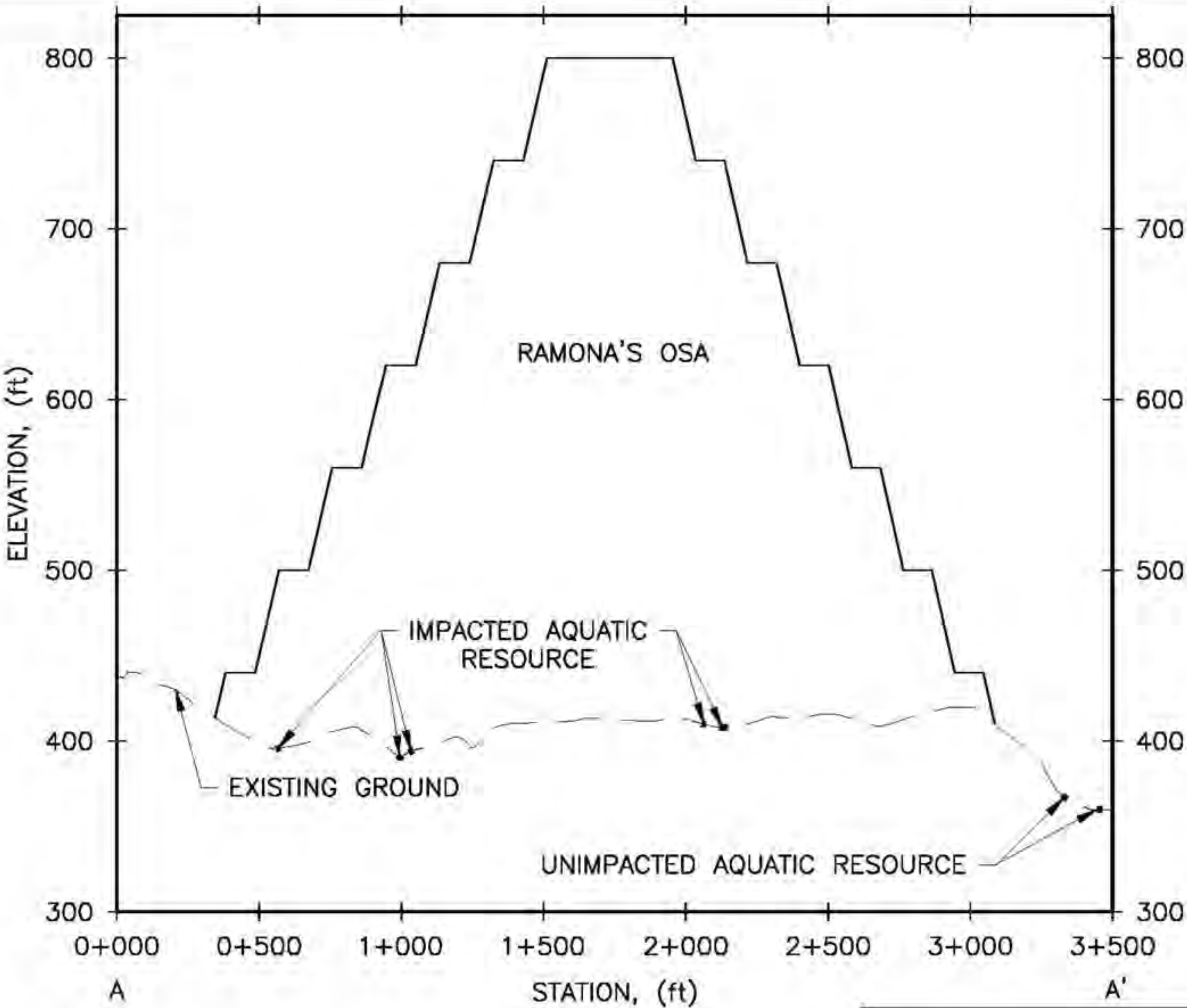
Legend

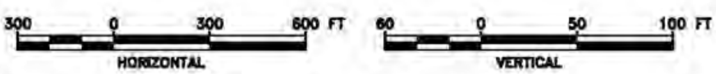
- **Property Boundary**
- **Stream Impact**
- **Wetland Impact**
- **Exclusion Area**
- **Wetland/Stream**
- **Existing Culvert**
- **Sheet Match Line** (13)
- **Stream Reach ID**
- **Schematic Cross-Section**

0 200 400 Feet

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067





SECTION A

SHEET 16 of 30

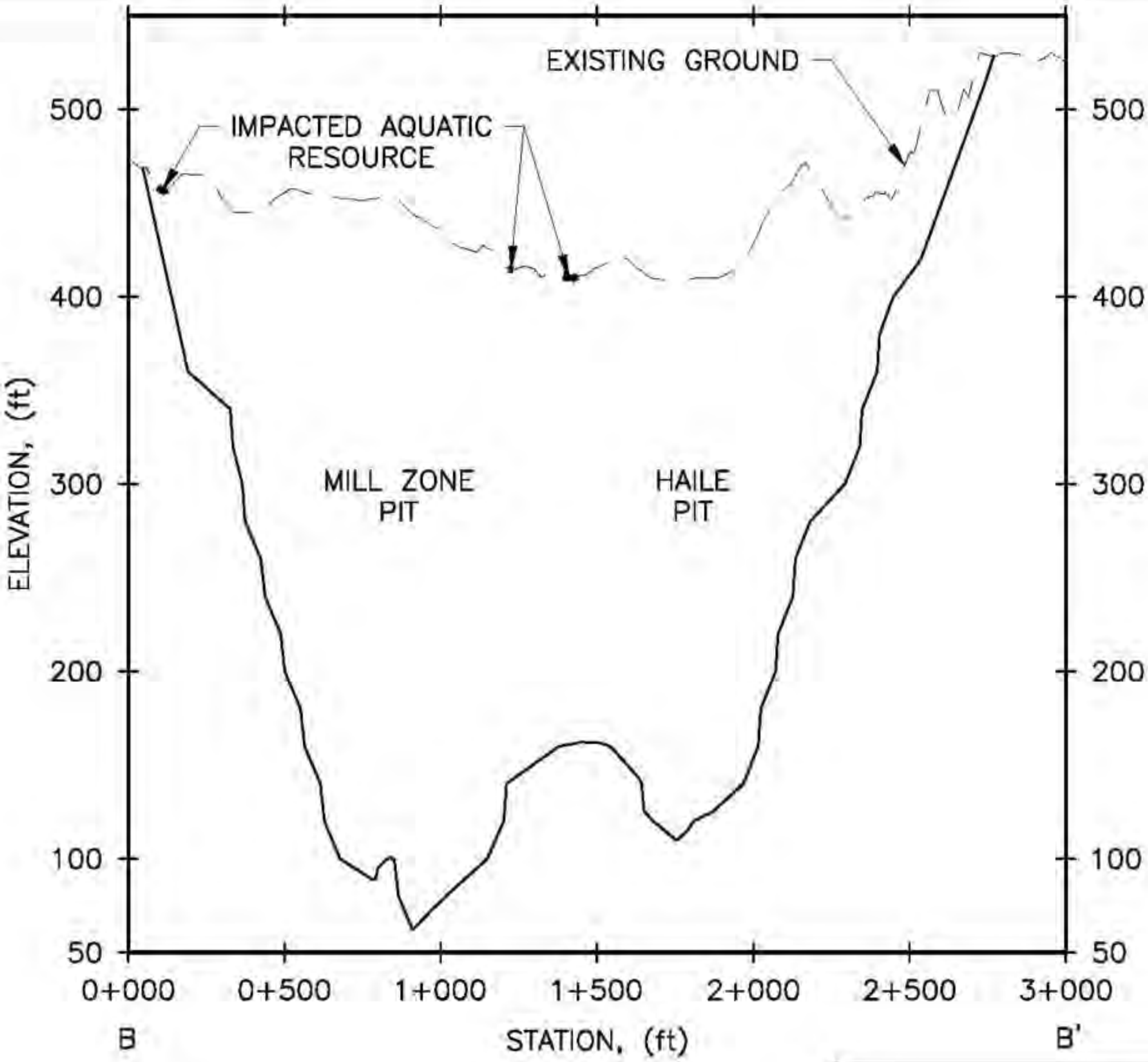
Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

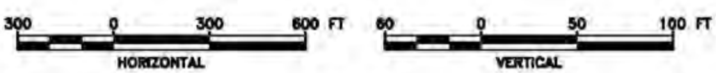
Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

Schematic Cross-Section

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067





SECTION B

SHEET 17 of 30

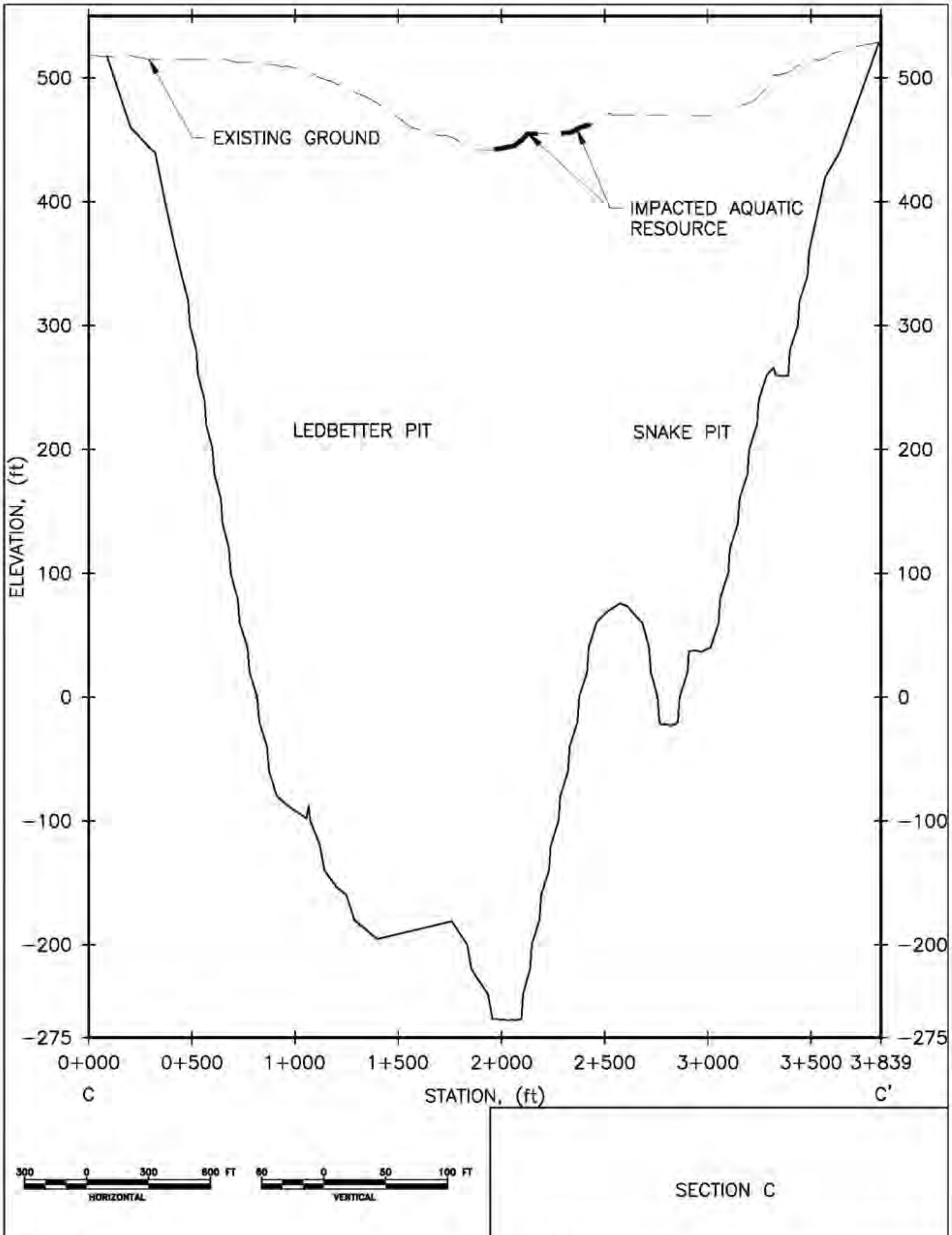
Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

Schematic Cross-Section

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SECTION C

SHEET 18 of 30

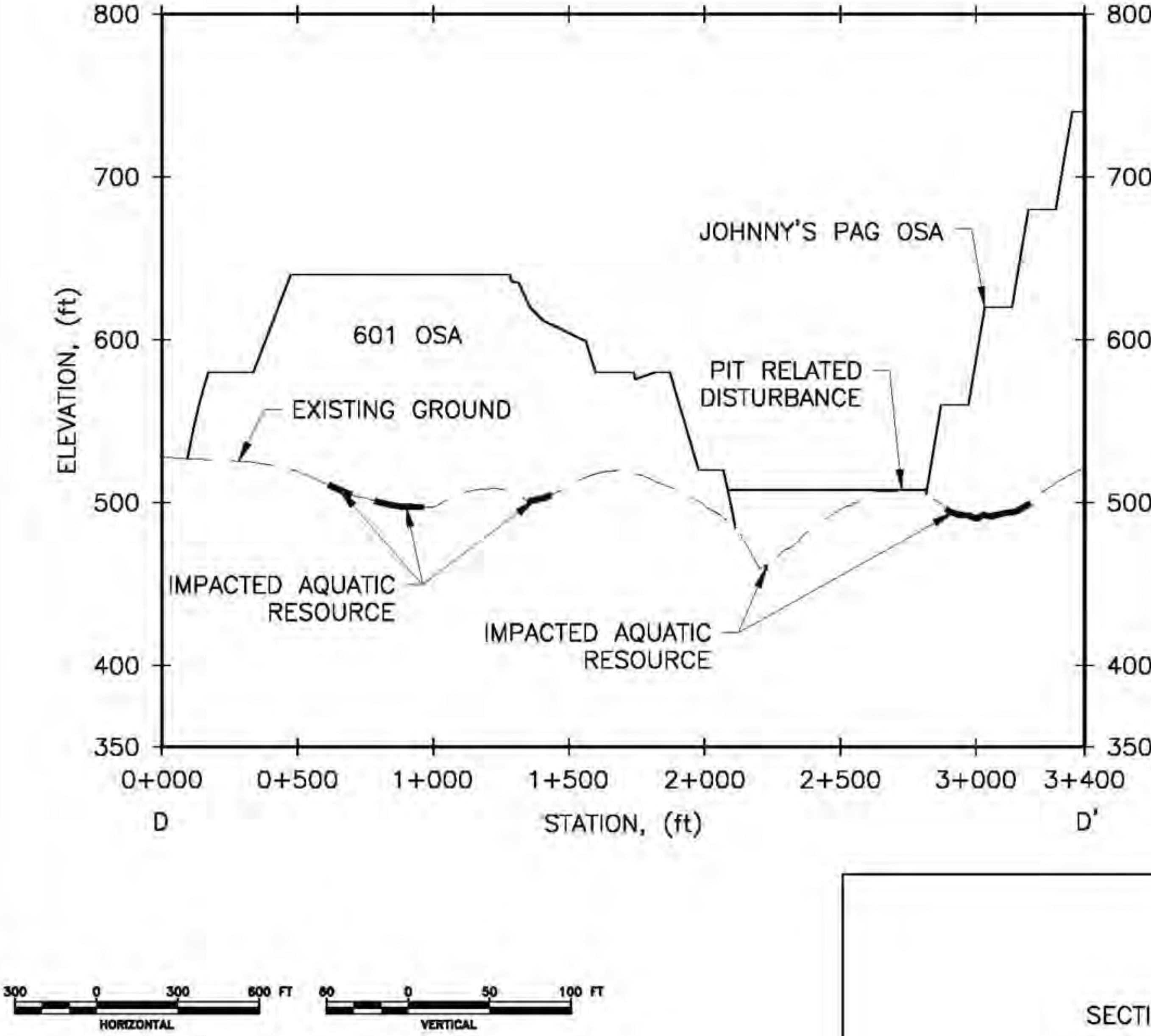
Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

Schematic Cross-Section

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SECTION D

SHEET 19 of 30

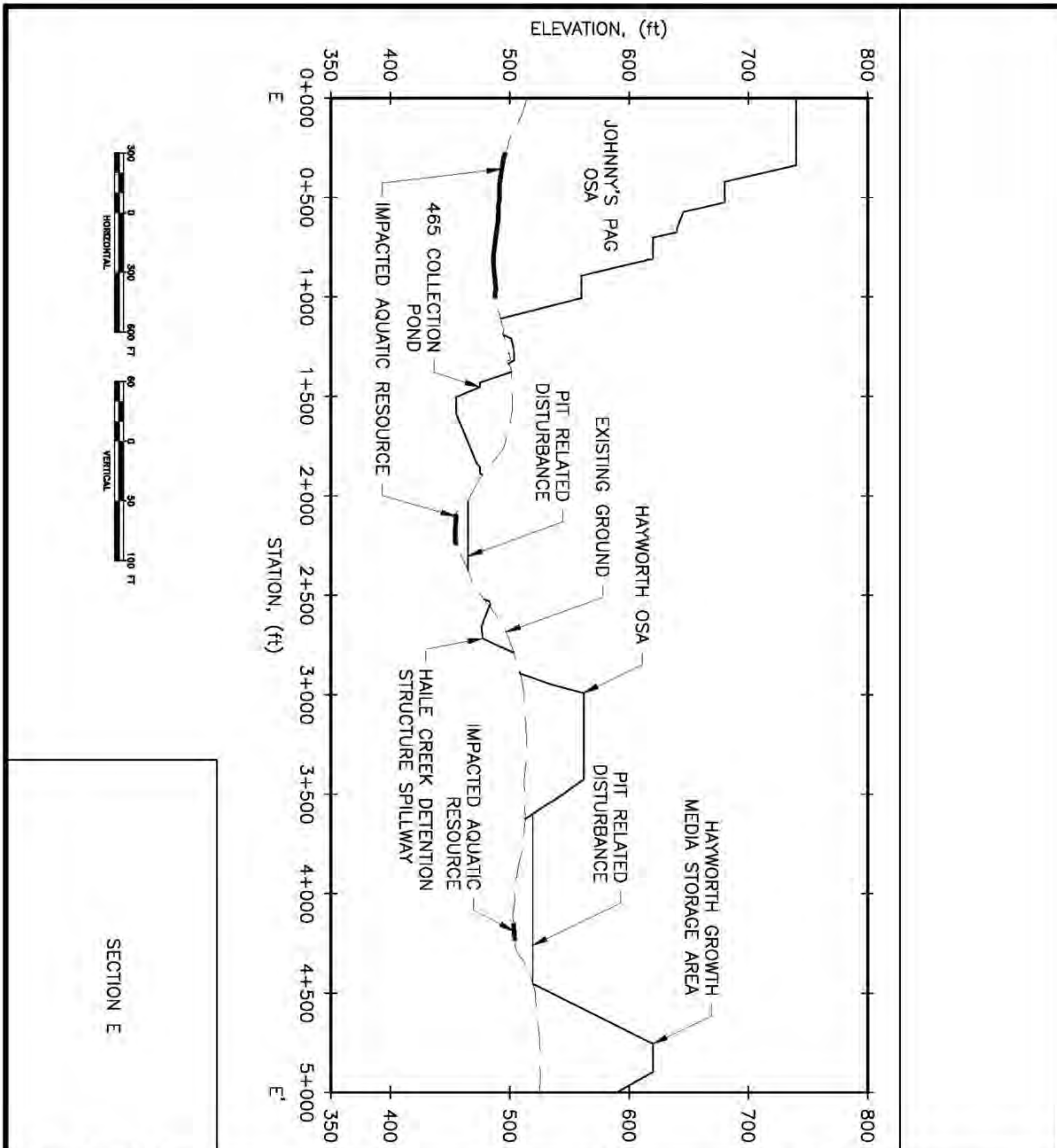
Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

Schematic Cross-Section

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SHEET 20 of 30

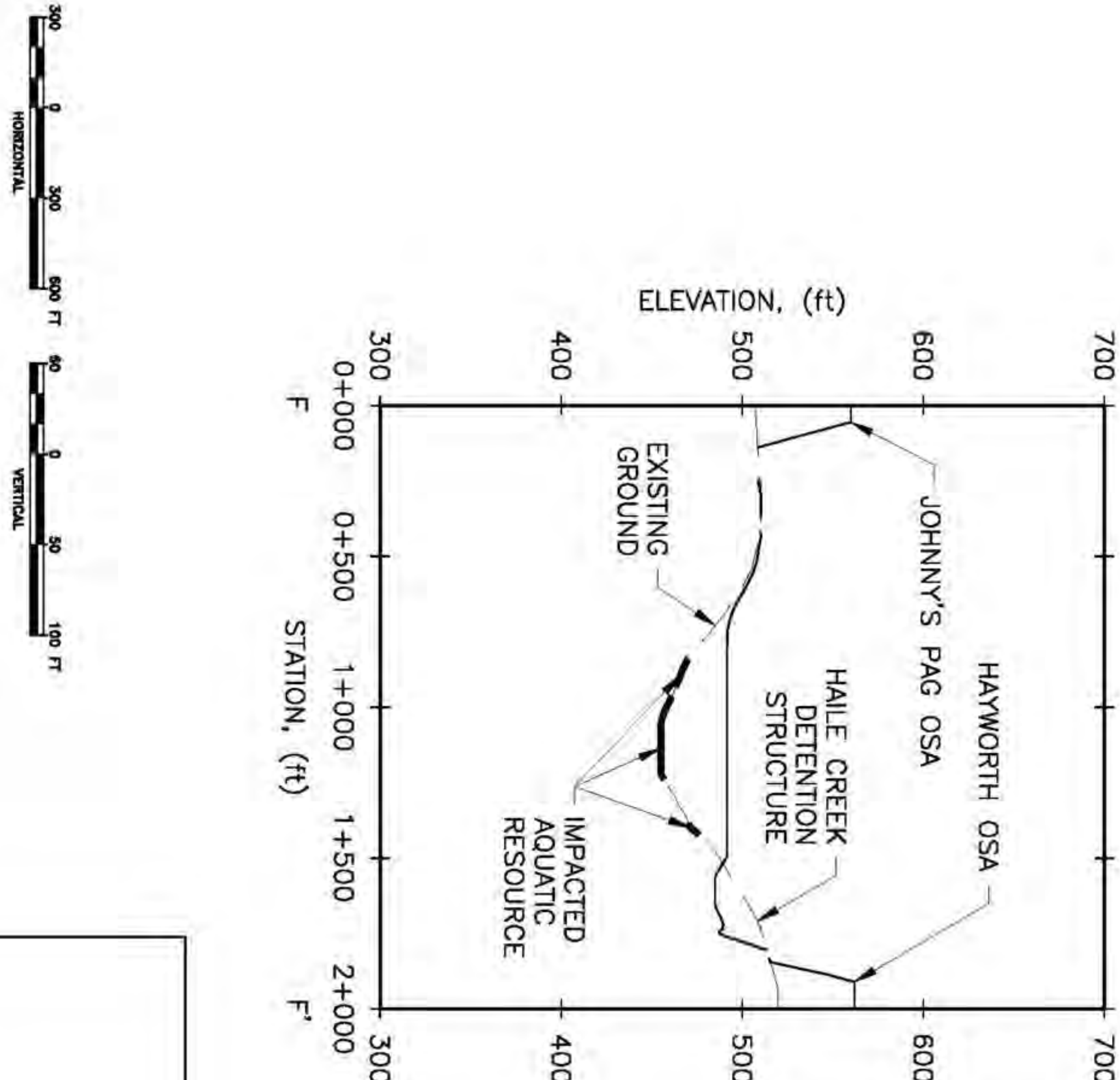
Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

Schematic Cross-Section

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SECTION F

SHEET 21 of 30

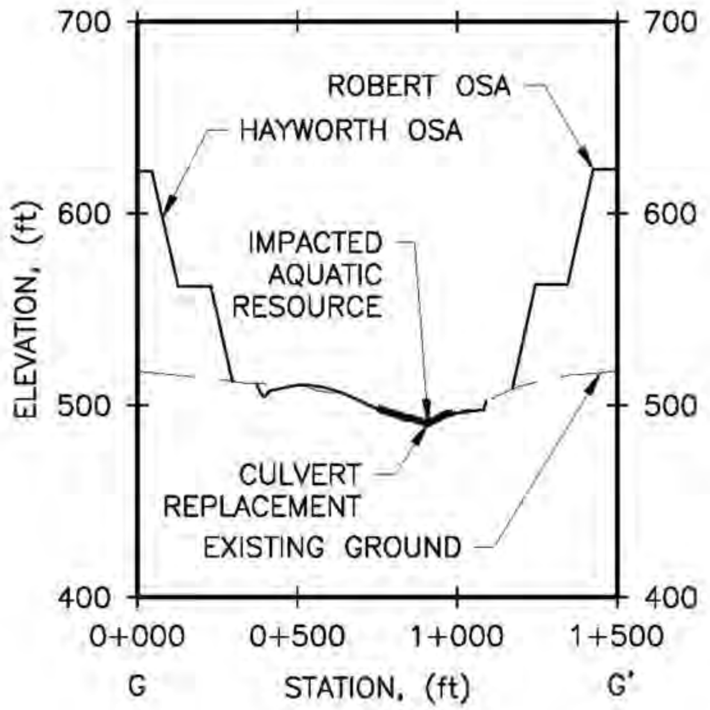
Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

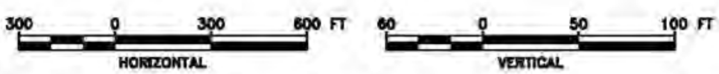
Drawn by: ERC	Date: August 15, 2012	*Note: Refer to 2012 Revised Permit Application.*

Schematic Cross-Section

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067





SECTION G

SHEET 22 of 30

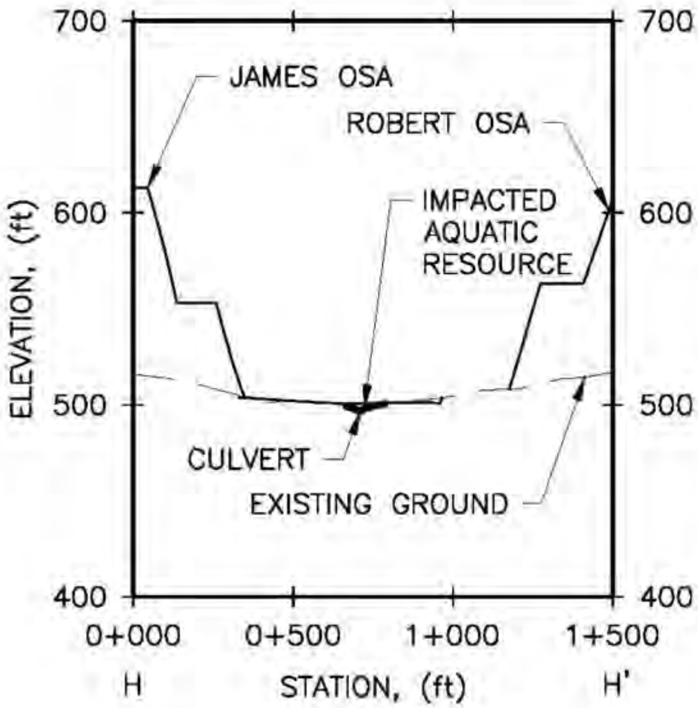
Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

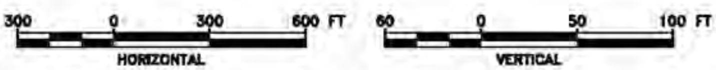
Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

Schematic Cross-Section

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067





SECTION H

SHEET 23 of 30

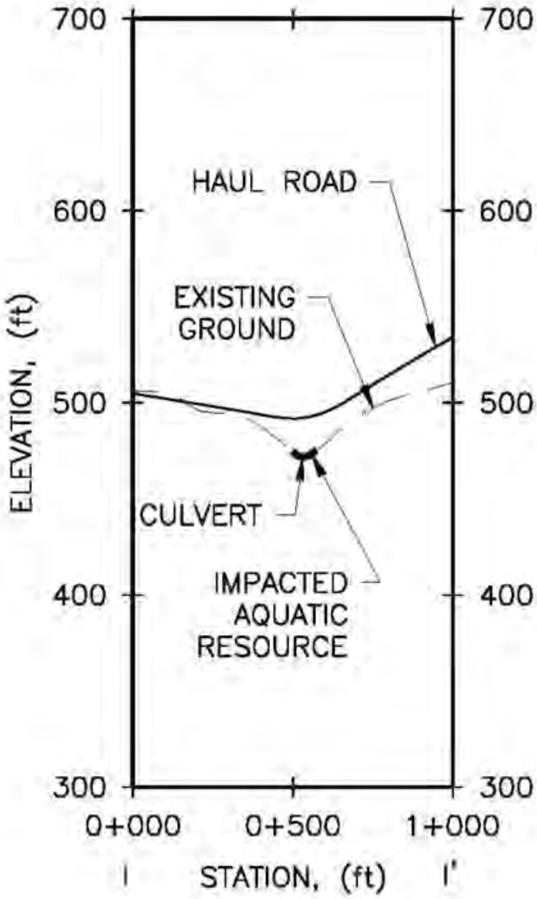
Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

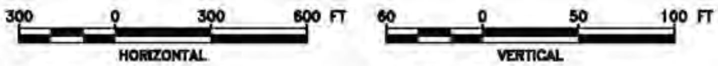
Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

Schematic Cross-Section

HAILE GOLD MINE PROJECT
(SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067





SECTION I

SHEET 24 of 30

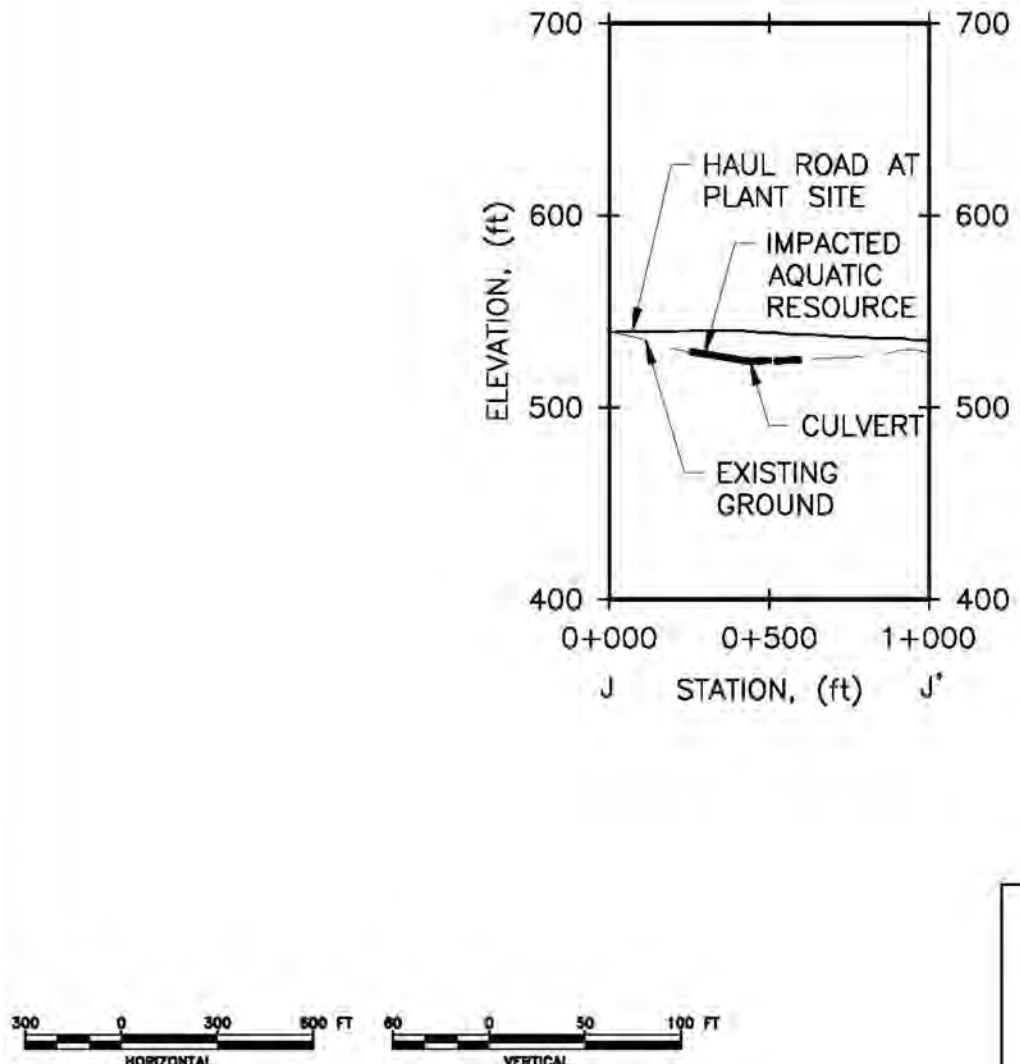
Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

Schematic Cross-Section

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SECTION J

SHEET 25 of 30

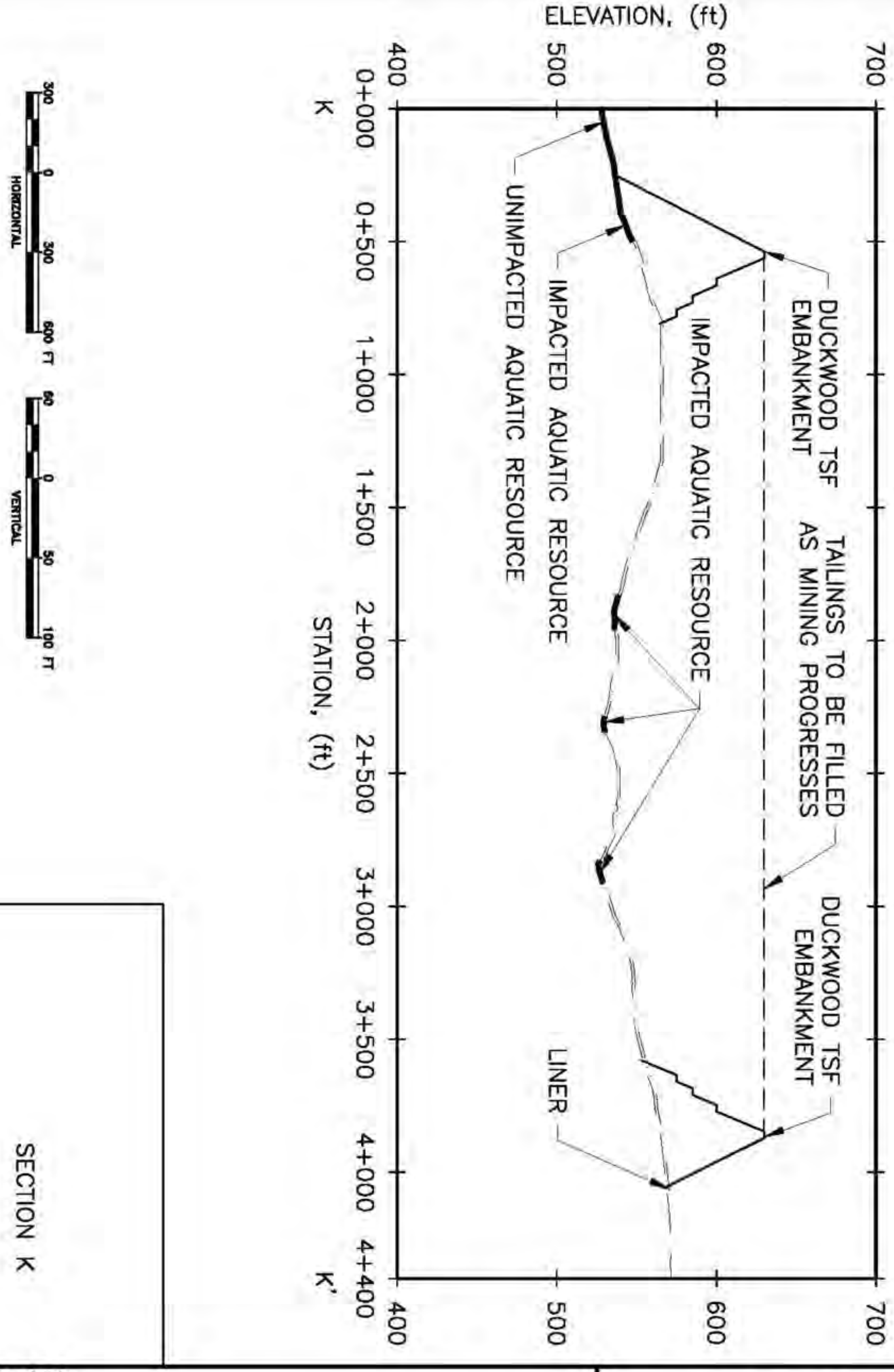
Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

Schematic Cross-Section

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SHEET 26 of 30

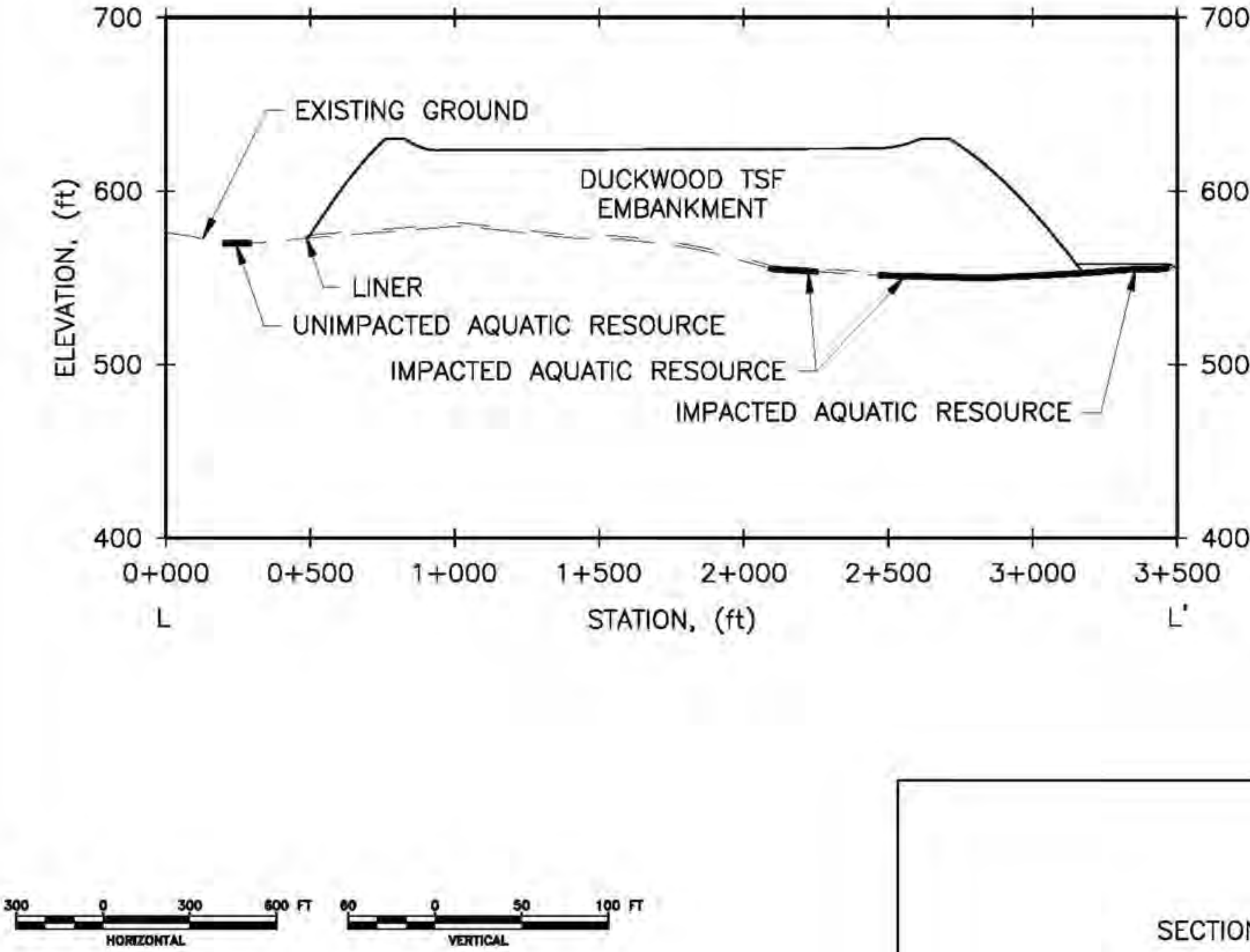
Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC	Date: August 15, 2012	*Note: Refer to 2012 Revised Permit Application.*

Schematic Cross-Section

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067



SECTION L

SHEET 27 of 30

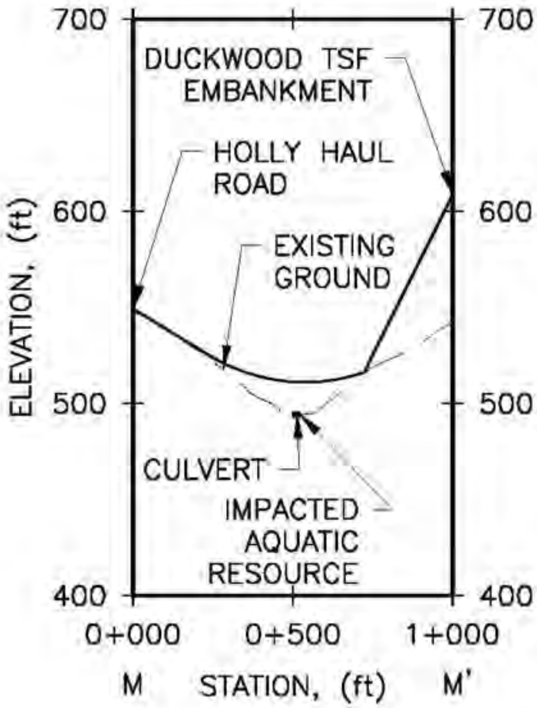
Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

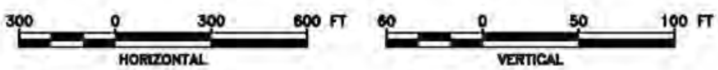
Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

Schematic Cross-Section

HAILE GOLD MINE PROJECT
(SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067





SECTION M

SHEET 28 of 30

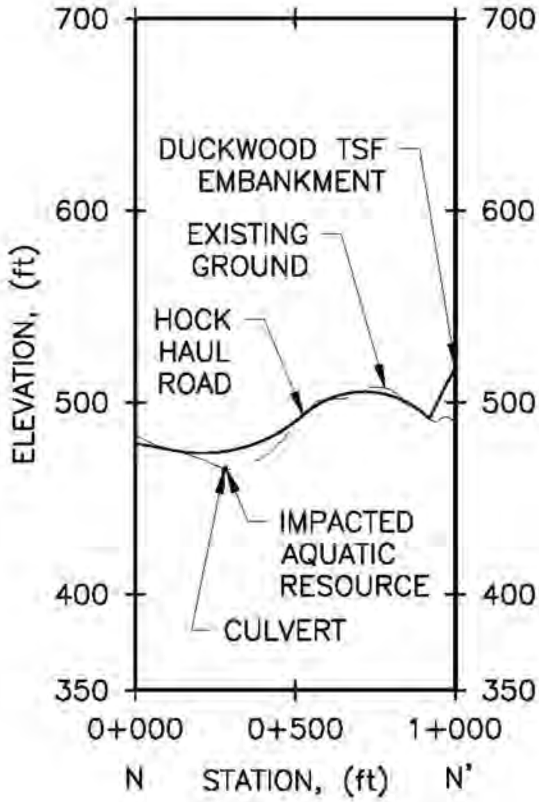
Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

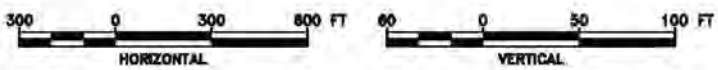
Drawn by: ERC	Date: August 15, 2012	*Note: Refer to 2012 Revised Permit Application.*

Schematic Cross-Section

HAILE GOLD MINE PROJECT
(SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067





SECTION N

SHEET 29 of 30

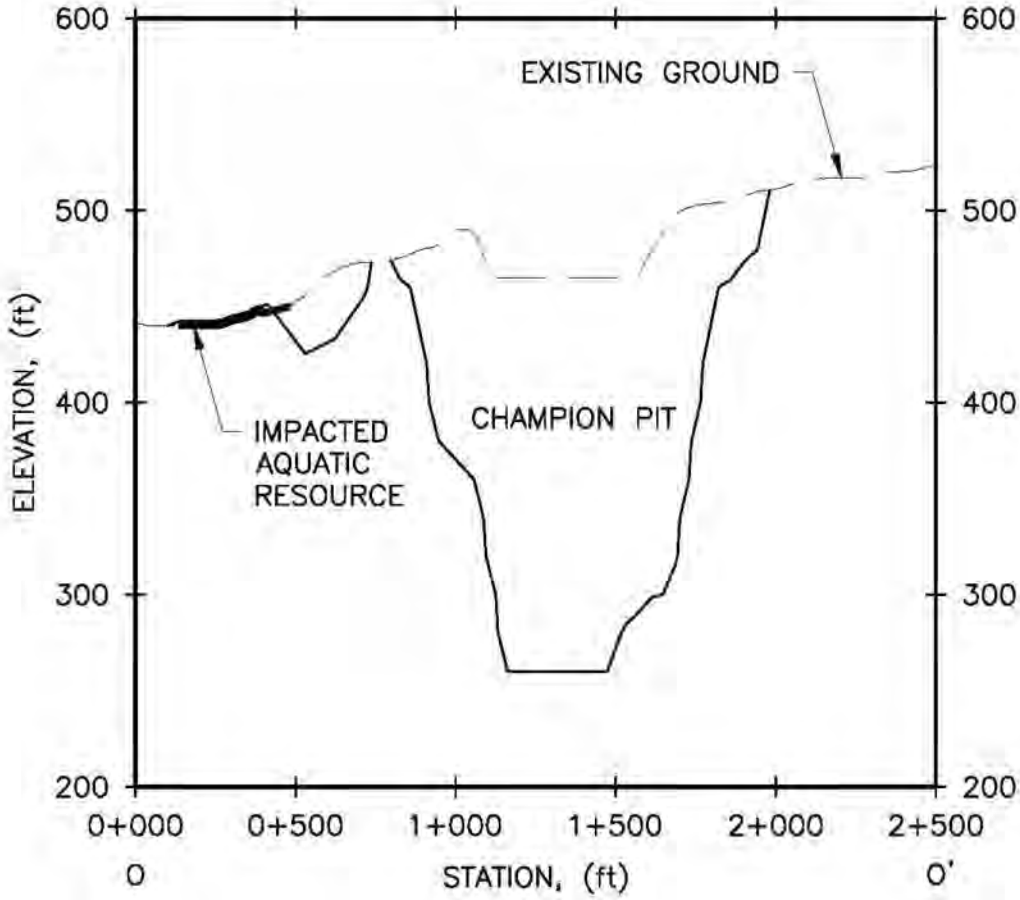
Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

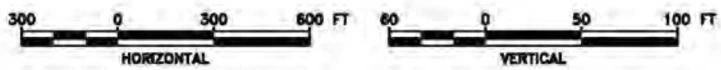
Drawn by: ERC | Date: August 15, 2012 | *Note: Refer to 2012 Revised Permit Application.*

Schematic Cross-Section

HAILE GOLD MINE PROJECT (SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067





SECTION O

SHEET 30 of 30

Haile General Layout
Waters of the US Direct Impact Analysis Detailed Plan

Drawn by: ERC	Date: August 15, 2012	*Note: Refer to 2012 Revised Permit Application.*

Schematic Cross-Section

HAILE GOLD MINE PROJECT
(SAC 1992-24122-4IA)

Haile Gold Mine Inc.
7283 Haile Gold Mine Road
P.O. Box 128
Kershaw, SC 29067

This page is left blank intentionally.